Agriculture

630
Ag8

December 1959

Volume LXVI Number 9

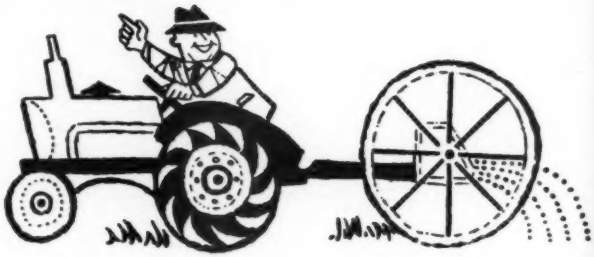
THE JOHN CRERAR LIBRARY
JAN 1960

Published for the Ministry of Agriculture, Fisheries and Food
by Her Majesty's Stationery Office

NINEPENCE MONTHLY

'KAYNITRO'

perfect partner for basic slag



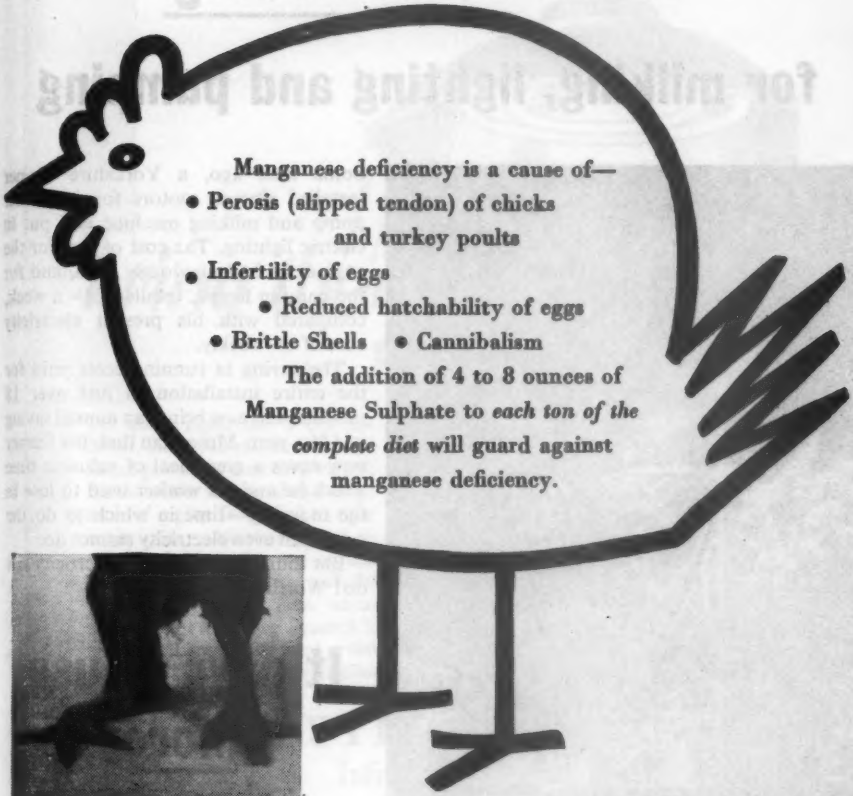
For the best early grass next spring
follow Basic Slag with 4 cwt. 'Kaynitro' per acre.
By using 'Kaynitro' granular compound
fertilizer—containing 16% N and 16% K_2O—
you can apply two essential plant foods
in one time-saving job.

Order from your merchant now and be sure of getting 'Kaynitro' on your farm when you need it.

ICI

IMPERIAL CHEMICAL INDUSTRIES LTD

Poultry need MANGANESE



Manganese deficiency is a cause of—

- **Perosis (slipped tendon) of chicks and turkey poults**
- **Infertility of eggs**
- **Reduced hatchability of eggs**
- **Brittle Shells**
- **Cannibalism**

The addition of 4 to 8 ounces of Manganese Sulphate to *each ton of the complete diet* will guard against manganese deficiency.

Perosis or 'slipped tendon' in a chick caused by manganese deficiency.

★ ***Insist that your purchased mashes and pellets contain sufficient manganese and make sure your home-grown foods are supplemented with this essential nutrient.***

Chemical & Carbon Products Ltd

14J, NEW BURLINGTON STREET, LONDON, W.1. TEL.: REGENT 1921

Farmer saves £46 a year with electricity

for milking, lighting and pumping

Some time ago, a Yorkshire farmer installed electric motors for his water pump and milking machine and put in electric lighting. The cost of fuel for the engines he had previously used, and for the paraffin lamps, totalled 24/- a week, compared with his present electricity cost of 6/- weekly.

The saving in running costs paid for the entire installation in just over 18 months, and now brings an annual saving of £46 a year. More than that, the farmer now saves a great deal of valuable time which he and his worker used to lose in the morning—time in which to do the work that even electricity cannot do.

But think of all the jobs electricity can do! Worth looking into?

It pays to use more electricity

Electricity is clean, efficient and economical. It saves time and money. It can free skilled labour. It increases productivity. In a hundred different ways, it pays.

For expert advice consult your Electricity Board. They will be glad to help you.

Electric lighting in a farmyard

Issued by the British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

bring them on with infra-red

For about eightpence a day, the 300w. AEI dull-emitter infra-red heater provides penetrative warmth for the winter rearing of an average litter of piglets from birth to eight weeks old. Alternatively, it is suitable for brooding up to one hundred day-old chicks, and for general use on the farm where local warmth for young livestock is required. Larger units rated at 600 watts are also available (with pilot light if required).

PYROFLECTOR

Infra-Red Heating Unit

List prices

300 watt	£3 15 6
600 watt (with pilot light)	£7 18 9
600 watt (without pilot light)	£6 16 6

complete with suspension chain and connecting cable.

AEI

Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY AND MANCHESTER

INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V

A3582

No more slow starts this winter! No more sluggish hydraulics!
(And no more worry about different grades of oil either!)

TRACTOR OILS UNIVERSAL*

are here to save your time (read section A below) and money (read section B below)

***Either Shell Tractor Oil Universal or BP Energol Tractor Oil Universal**

(a) **Tractor Oils Universal are the tractor oils of the future. They are not only multi-engine oils - i.e. can be used in tractor engines of all types - petrol, V.O., diesel - all year round: they are multi-purpose oils that can be used in transmission and hydraulics as well. And what's more they give improved performance. Nothing like this has ever been offered to farmers before.**

Switch to Tractor Oils Universal in engine, transmission and hydraulics and you'll save yourself *time* in these vitally important ways. One, you'll get far better winter starting from all your tractor engines. Two, on cold mornings your hydraulics will operate far quicker and get through work much faster. Tests organised by The National Institute of Agricultural Engineering – and a further special series of tests in Sweden – have *proved* this to be true. Three, you'll save yourself time on ordering tractor oil . . . filling up tractors with oil . . . because the one oil – a Tractor Oil Universal – *does the whole job.*

(b) Tractor Oils Universal mean money saved too! In these ways. One, tractor engines that are cleaner-running, longer-lasting than with ordinary oils. Two, added protection against corrosion in the transmission and hydraulic system. Three, less oil used in V.O. engines. Four, longer battery life. Remember too that Tractor Oils Universal vastly simplify handling . . . eliminate completely the risk of such costly errors as putting 'the wrong oil in the wrong place'.

Cold weather tests run by the National Institute of Agricultural Engineering* (see picture) proved that Tractor Oils Universal gave better results in hydraulics. After tests carried out in Sweden the consulting engineer Erik Edvall wrote: "The tests have shown clearly that . . . this universal oil is far superior to the transmission oils usually recommended."
**(Report No.* 191A)

These are the points to bear in mind

Shell Tractor Oil Universal and BP Energol Tractor Oil Universal . . .

- Can be used in Engine – Transmission – Hydraulics – The lot . . . All the year round
- Are approved for all Fordson Tractors made since 1952 – All Massey-Ferguson Tractors made since 1946 – International Harvester Tractors Models B450, B275, B250 – David Brown Tractors Series 900 and 950 – All Nuffield Universal Tractors
- Give *much* easier winter starting
- *Double* the period between oil changes in V.O. engines
- Give up to *five times quicker hydraulic action* in winter
- Eliminate all risk of 'wrong oil in the wrong place' – only one oil to stock

For details of who to contact . . . or more information about Tractor Oils Universal, *see your local newspaper.*

BIG FARMERS' EXPERIENCE

Already many of the country's leading farms are using Tractor Oils Universal in all tractors. Among them are:-

Strutt & Parker (Farms) Ltd. and Lord Rayleigh's Farms Incorporated – with tractors of all types.

The Marquess of Exeter's Pickworth Farm at Stamford.

Sir Peter Greenwell's Sudbourne Hall Estate near Woodbridge, Suffolk.

The Stephensons' Estate at Market Weighton, East Riding.

This advertisement is prepared for your information by
THE SHELL AND BP FARM SERVICE

Agriculture

Volume LXVI Number 9 December 1959

EDITORIAL OFFICES
THE MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
WHITEHALL PLACE · LONDON S.W.1 · TRAFALGAR 7711

CONTENTS

Sixty Years of Saxmundham: 1. *Sir E. John Russell* 375
Modern Thinking on Pig-housing. *D. S. Soutar* 379
Drinking Habits of Grazing Cows. *D. S. MacLusky* 383
Beef from Breeder to Butcher. *K. MacLeod* 387
Fertilizer Practice Surveys. *B. M. Church* 389
Manuring Barley on Chalk. *H. W. Gardner* 396
Dairy Show, 1959. *George Jarrett* 398
Poultry Equipment in Russia. *R. Coles* and *R. F. Gordon* . . . 400
Principles of Glasshouse Heating. *L. G. Morris* 403
Improvement of Horticultural Production and Marketing . . . 407
Sheep Recording. *H. F. Fieldsend* 410
The Year's Weather. *L. P. Smith* 413
Farming Cameo Series 2: 20. West Gloucestershire. *R. Guy Haines* . 416
At the Farmers' Club. *Sylvia Laverton* 418
Ministry Publications 420
In Brief 421
Book Reviews 423

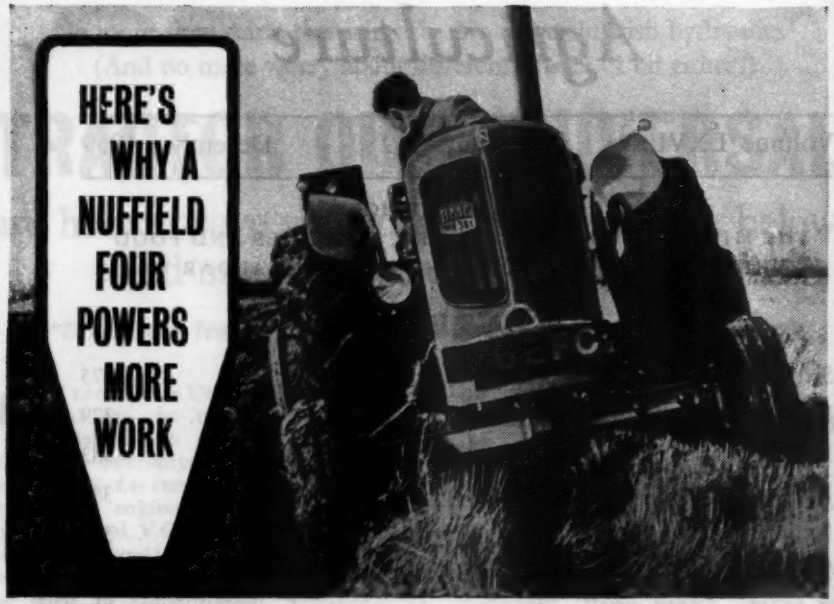
Cover photograph: The waiting gun *Photo: John Tarlton*

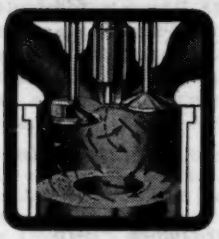
Provided that the source is acknowledged in each instance, such articles and notes as are published in this Journal without any specific reservation regarding copyright may be reproduced in any registered newspaper or public periodical without special permission. The Ministry does not accept responsibility for statements made, or views expressed, in signed contributions to this Journal or in those reproduced from another source.

Further, the Ministry does not accept responsibility for any of the private and trade advertisements included in this publication.

In the interests of factual reporting, occasional reference in this Journal to trade names and proprietary products may be inevitable. No endorsement of named products is intended, nor is any criticism implied of similar products which are not mentioned.

All communications respecting advertising in the Journal should be addressed to the Advertisement Contractors, Cowlishaw and Lawrence (Advertising) Ltd., 14—16 Ludgate Hill, London E.C.4. Telephone: City 3718.





B.M.C. 3·4 LITRE DIESEL

Masked inlet valves create air swirl in the cylinder head ensuring efficient combustion, economical running and easy starting. Wet cylinder liners improve cooling and are easy to replace. The rigid, five-bearing, balanced crankshaft ensures smooth running. This rugged engine develops 56 b.h.p.

TWELVE MONTHS' WARRANTY

and backed by B.M.C. Service.

U.180

Other land-proved features offered include:

DIFFERENTIAL LOCK This pedal-operated device counteracts wheelspin and gives tenacious traction. Normal drive becomes effective immediately pedal pressure is relaxed. Drawbar with alternative hitch points also helps to overcome wheelspin.

EXTENDED REAR AXLE

The popular adjustable sliding rear hubs allow a quick and easy track change and cost so little more.

P.T.O. and I.P.T.O. (designed to B.S.I. and A.S.A.E. standards). P.T.O. is engaged by means of a dog-clutch. I.P.T.O. drive is via an independent plate-clutch, the drive is uninterrupted by tractor stops or starts, or by gear changes.

EASE OF CONTROL

Deep seat automatically corrects for angle and leg length. Handy controls, shields and non-slip surfaces ensure complete comfort and safety.
Five-speed gearbox (plus reverse) provides range of speeds between ·9 m.p.h. and 17·3 m.p.h.
Unit construction of engine, clutch and other parts eases maintenance.
Your Nuffield Dealer will tell you all about standard features and the wide range of extra equipment available.

NUFFIELD UNIVERSAL FOUR

Your second tractor? Ask to see the NUFFIELD UNIVERSAL THREE

MORRIS MOTORS LTD. (AGRICULTURAL DIVISION) COWLEY, OXFORD.

Overseas Business: Nuffield Exports Ltd., Oxford and 41-46 Piccadilly, London, W.1.

Sixty Years of Saxmundham

1. The Results Achieved

SIR E. JOHN RUSSELL, O.B.E., D.SC., F.R.S.

It seems unlikely that whisky money and a public outcry should have helped to start some of the most valuable fertilizer experiments in Britain, but so it was, and the early history and subsequent progress of these experiments make fascinating reading.

THE experiments at Saxmundham, now in their sixtieth year, have made the experimental field there one of the most useful in British agriculture. The purpose of the work was simple enough: it was to discover the effects of artificial fertilizers on five of the crops then most important for Suffolk farmers on this rather unkindly clay soil. It was guided by the Suffolk Education Committee, the chairman of which, Mr. Alfred Harwood, was a great country gentleman and very much interested in all that concerned Suffolk agriculture.

The work had come under the Education Committee by one of those strange accidents which make one feel that a special Providence must be watching over our land. A few years previously, the Government had been greatly perturbed by the amount of drunkenness which they believed was fostered by the large number of public houses in town and country, so they decided that a good number of them should be closed. This meant, of course, extinguishing the licences, and a compensation fund was raised by taxing beer and spirits in proportion to the alcohol they contained: it was known as the whisky money. The tax was collected, but when the public realized that it would go to the brewers, who owned most of the licences, there was such a great outcry that the Government decided that they could not use the money for compensation, but must do something else with it. They were in the awkward predicament of having several hundred thousand pounds a year, but nothing to spend it on.

The matter was discussed in the House of Commons, but no one was greatly interested. The House was half empty and sleepy when Mr. Acland proposed that the money should go to the counties for technical education: later came the proviso that if they did not want technical education, they could use the money for the relief of the rates. Acland's proposal was adopted, and the counties came into possession of funds for technical education, which for most of them meant agricultural education.

"We could always import all our food"

The idea of agricultural education was not particularly well received, however, by the general run of farmers. They were in the middle of a twenty-year spell of severe agricultural depression, which hit the corn growers especially hard; Canada, the United States and Australia were marketing wheat at prices with which they could not possibly compete. For the previous seven years the price of wheat had been about 26*s.* a quarter—about £6 a ton. What the farmers wanted was protection. But free trade and unrestricted

competition were the order of the day, and many people thought that we should do far better to devote ourselves entirely to manufacturing and business activities and not bother about agriculture at all. We could always import all the food we wanted, they said. Sir Daniel Hall went to the Board of Agriculture about that time to ask for a grant for agricultural research; he was refused, and the official added that he could not imagine the circumstances in which the Board would be interested in research work. Later and, of course, unofficially, he told Hall that in his view British agriculture was dead, and the business of the Board was to give it a decent burial. Earlier, Sydney Webb, one of the leading political thinkers of his day, told me that Britain could not afford to indulge in farming. Britain was an industrial country, he said, and the land should be devoted to the people's recreation.

Fortunately, as usual in Britain, these extreme views were not acted upon; instead the Government accepted agricultural education as the best hope for solving the agricultural problem and, very fortunately, many of the best and most thoughtful farmers and landowners in the counties took the same line. So it came about that under the guidance of such men, Suffolk decided to use the whisky money for agricultural education. In due course another wise decision was made: you cannot teach farmers how to get higher yields unless you know something about how plants grow, and you cannot find that out except by experimenting with them. So the Rotation 1 experiments were designed by Mr. Harwood: so simple that anyone can follow the plan easily, yet so well planned that scientists can use the results as research material and get much valuable information out of them.

Rotation 1: The feeding of plants

The rotation adopted was one of practical importance, and the object of the experiments was to discover something about the feeding of plants. The subject was particularly appropriate here because this region, and especially Ipswich, had for more than fifty years been associated with the fertilizer industry—the Packards, the Prentices and later the Fisons were among the pioneers. The experiments set out to discover how the three groups of fertilizers N, P and K, singly and in combination, acted on the five selected crops grown in a rotation recognized by farmers as being sound. For comparison one plot was left untreated, and another had an annual dressing of farmyard manure. Very wisely, and this has given these experiments their distinctive character, the rotation has been continued unchanged all these years (except that clover or peas have on occasion replaced beans) and each plot has had the same fertilizer treatment year after year, without any change. The effects are therefore cumulative: the dressing of farmyard manure is only 6 tons an acre, but as it is given every year the plot has now received 360 tons per acre since the experiment started, while the untreated plot has been completely starved for sixty years. Only at two other places in the United Kingdom have similar long-continued experiments been made: Woburn and Rothamsted.

Workers of great integrity

Time has shown that the plan was good. But however excellent the plan, it would not have served its purpose, and might even have done positive

harm, unless the execution had been equally good. And here Saxmundham has been singularly fortunate, both in the expert supervisor and the foreman. For the first ten years Harry Fiske was in charge—a good farmer who had laid out the plots and started the work—then after a brief interregnum came Mr. Oldershaw, who for thirty-eight years supervised the work with a care and devotion that won him the greatest respect of his fellow workers all over the country. He was a man of unblemished integrity, and of complete intellectual honesty: you could always trust his figures and his observations, certain that these were the results he had actually obtained. There was no glossing over anything that looked wrong; scrupulous fidelity to the truth was one of the mainsprings of his life. I remember his coming here in 1911; in those early days I was able to visit the plots periodically and a lasting friendship grew up between us. I held him in high regard and it was with deep sorrow that I learned of his death a few weeks ago.

The station was equally fortunate in its foreman, Charles Cattermole, a great craftsman, who worked on the plots for the first forty years of their existence. This ensured a continuity of cultivation technique, and the maintenance of a steady, high standard of operations. I can recall him now, threshing out the barley with his flail, taking the utmost care to garner every grain, letting none be lost. He was one of those faithful farm workers who, year in and year out, have laboured to make the earth bring forth her increase and have done their work so well that the fields of England, though cultivated in many cases for well over a thousand years, are still giving higher yields than ever. Saxmundham has indeed been well served.

Fertilizers: the view in 1899

To assess the results properly you have to go back to what farmers knew about fertilizers in 1899. Fertilizers, of course, were not new. Superphosphate had been on the market for over fifty years, and nitrate of soda and sulphate of ammonia even longer, but the average farmer regarded them not as plant foods, but as stimulants. When I started my agricultural career in 1901, my farmer friends usually likened fertilizers to whisky and soda: an occasional glass would stimulate you to greater activity, but as a regular diet it would be pernicious. The only true plant food, I was assured, was farmyard manure; "artificials", as they were called, might give you big crops for a year or two, but in the end they would poison the land and perhaps you as well. Farmyard manure was the real thing: it could be used for ever and would always act well. This idea of an antagonism between farmyard manure and artificials was very widespread. In my lectures to farmers in those old days it was always expected that I should cry down farmyard manure and praise artificials: not infrequently my audience was disappointed because I did not. The local funny man was usually sitting in the back row waiting to fire off some of his old jokes at what he hoped would be appropriate places in my talk. I generally saw to it, however, that he got no change out of me.

Old ideas proved wrong

Here at Saxmundham there was a special interest in plots 1 and 10; plot 1 receiving only farmyard manure annually, and plot 10 receiving complete

artificials year after year and never any organic manure. But the expected failure of the artificial fertilizers did not appear: over the average of years, the yields, except of clover, have been the same for artificials as for farmyard manure. Further, after sixty years, when the total application of artificials has reached 15 tons an acre, there is still no sign that they have any harmful effect either on the crop or on the soil, though that question has not yet been properly studied. Farmyard manure has, however, had a beneficial effect on the soil which artificials have not: it can be seen at any time of the year, but particularly in spring when the farmyard manure plot can be worked earlier than the others, which of course is an advantage. But skilful cultivation gets round this difference, and, as already stated, except on the clover plot, the yields on the farmyard plot are no better than those on plots receiving complete artificials only, in spite of the advantage in soil condition. The experiment shows conclusively that the fertilizers are true foods and not stimulants.

The other plots showed what the individual fertilizers can do. Superphosphate has had a remarkable effect, especially on mangolds; without super, the mangolds shrivel down to ridiculous little things giving only 4 or 5 tons per acre. Super also has striking effects on clover and on beans, and to a less extent on wheat and barley. The experiments also show clearly that super acts best in combination with nitrogenous fertilizer. On the other hand, potash has not benefited the wheat, barley or mangolds until recently, but it has benefited beans and clover. This beneficial effect was not generally known by farmers in the early years, and as the other crops that most need potash—potatoes and sugar beet—were not grown then, and as mangolds did not usually yield much more than 20 tons per acre, it is not surprising that potassic fertilizers were but little used.

Rotation 2: How best to use FYM

The main purpose of Rotation 2 was to discover which crop in the rotation could most advantageously receive the farmyard manure: should it be the wheat, which was the old-established practice in Suffolk, or the mangolds? Also where should the fertilizers best go? The interest is more local than that of Rotation 1: the experiment is also more complex and its results are not yet fully worked out.

The grassland experiments were started in the Station's second year. Twenty years of depression had caused a lot of arable land to go derelict, covered with a mass of self-sown plants, mostly weeds but with some wild grasses and clovers; it was justly called "poor grass", and experiments were started to improve it. Ploughing up and reseeding was recognized as the best way. The history of these grassland experiments illustrates the remarkable development of grassland research in this country during the last fifty years. The first mixtures sown were those designed by Mr. R. H. Elliot of Clifton Park, Roxburghshire, and included deep-rooting plants like chicory, to open up the subsoil and so give more scope to the grass roots. Then followed Sir William Somerville's mixture, based on his experiences first at Cockle Park and then at Cambridge; later came the new Aberystwyth strains produced by Sir George Stapleton. This Saxmundham work made its contribution to the East Anglian grassland problems which, however, are still difficult.

Some useful experiments were made at Tunstall on a very acid sand; they

were important because they showed so clearly the effects of soil acidity on the growth of crops. I never saw better examples: I used them regularly in writing and lectures, and always regretted that shortage of staff prevented us at Rothamsted from making a full investigation of this important subject. Nowhere could we have found better material.

These experiences at Saxmundham have served a very useful purpose and have helped not only the farmers of East Suffolk, for whose benefit they were started, but a wide range of farmers, teachers in agricultural colleges, and experts outside. But no station can live on its past history, however fruitful that may have been. What of the future? I shall speak only of Rotation 1, because that is the best known. I feel strongly that it should be continued on its present lines because it is the only field in England that can supply the research material it provides. There are several directions in which important work still remains to be done: these will be described next month.

Modern Thinking on Pig-housing

D. S. SOUTAR, A.R.I.A., A.A.(HONS.)(DIP.), A.R.I.A.S.
North of Scotland College of Agriculture

This article is based on the section dealing with *Pig Housing* from the first Bledisloe Memorial Lecture, *Current and Future Developments in Farm Buildings*, which was given by Mr. Soutar at the Royal Agricultural College, Cirencester, on 3rd October. We are grateful to the Royal Agricultural College Association for permission to reproduce this excerpt.

THERE has been a very marked increase in efficiency in the pig industry in post-war years. In rearing, for instance, whereas the average litter used to be six pigs of twenty-five pounds at weaning, today it is eight pigs of thirty-five pounds. The developments in pig-housing have undoubtedly helped considerably in achieving this increased efficiency as the pig, of all our domesticated animals, reacts most sensitively to its environment. The pioneer work of the late A. A. McGuckian pointed the way to the benefits of a properly controlled environment, achieved by insulation and controlled ventilation; if this country had had an organization to coordinate the experiences of those pioneering new designs, our housing standards today would be much higher.

While lacking precise knowledge of the ideal environmental conditions for the various classes of pig, the work of Sainsbury and others has indicated the need for a dry bed, facilities to dung away from the bed, fresh air without draughts, freedom from temperature fluctuations, and temperatures ranging from approximately 60°F in the fattening-house through 65–70°F in the farrowing-house to 75° in the piglets' nest. Humidity in the range of temperatures stated appears to be relatively unimportant, but high humidities at

low temperatures lead to grave disorders. The importance of the periodic, thorough disinfecting and resting of pig-houses is increasingly being stressed.

In Northern Ireland, pigs have been successfully housed at temperatures and humidities which previously would have been considered most inadvisable. While successful, such housing has certain drawbacks, and as latest reports indicate a modification of earlier conditions, the "high humidity" system will not be discussed here. However, the simplicity of the system and its success deserve fullest consideration.

Effects of environment on thriftiness

The first work on the effect of environment on thriftiness to be carried out under the controlled conditions of a psychrometric chamber was reported in 1949, by Heitman and Hughes of Davis, California, who pronounced that for maximum liveweight gain, pigs from 70 to 144 lb required a temperature of 75°F and pigs from 166 to 260 lb a temperature of 60°F. They further suggested that when air temperature was increased or decreased beyond these averages, growth and food conversion rates declined. More recent work by Heitman, Kelly and Bond at the same centre supports the earlier findings, and accurately reports the losses involved in neglecting the suggested standards. Speaking on this work at the F.B.A. Conference in Harrogate this year, Hollinrake pointed out the very considerable financial losses it demonstrated as arising from lack of temperature-control relative to pig weight and said that, while both American pig breeds and feeding were involved, the results of the American work tallied very closely with results achieved in some work in this country with which he was concerned. How far it is economically possible to provide precise temperatures for the varying weights of pigs involved in commercial pig feeding will vary according to the size of the unit, but in large-scale enterprises the benefits could be very considerable.

The maintenance of good health is perhaps the most important objective in pig-housing. This is being achieved in the farrowing and rearing period under systems as widely different as the "Roadknight" open air system and the intensive, climate-controlled crate-pen house. Fattening-house systems show more agreement in the relative importance of the factors involved, but the different husbandry methods applied make direct comparison difficult.

It is impossible to consider here all the types of housing now being developed, but a few of the more prominent trends must be mentioned. Far more attention is being paid to the welfare of the sow and, on service after weaning, she is being given more individual housing and feeding until she can regain the strength to fend for herself in the herd. Again, nearing the farrowing, she is being fed in individual stalls to ensure her healthiest condition at her most crucial period. A wide variety of individual feeding stalls and fittings are proving a profitable investment.

"Outdoor" rearing

The portable ark has reached a high degree of development with insulated walls and roof, wind-proof porches and doors, nests and feeding creeps for the piglets, and anti-crush rails. It is used mainly in conjunction with fold units, and moved regularly on to clean ground. In contrast to this system of

isolation of units, the "open air" enthusiasts run their sows in large groups which farrow in spring and autumn, their housing comprising very simple, floorless shelters. The sows are group-fed, and the piglets have access to large, communal creeps. It is essential for this system that the sows farrow more or less at the same time, and are of a strain capable of withstanding the more severe conditions involved. The system requires ample pasture to ensure clean ground for each group at farrowing.

Farrowing- and rearing-pens

It is generally agreed that farrowing- and rearing-houses should be fully insulated, with controlled ventilation and, preferably, some form of space heating supplementary to the heat lamps over the piglets' nest, to maintain a room temperature of 65–70°F. Electric floor heating has not been adopted to any extent.

Increased importance is being placed on the complete isolation of litters and, to this end, full height pen division walls are built, while sweep-through dung passages are not advised. Hygiene is receiving more attention, and houses are being designed in sections which can be shut off, disinfected and rested in rotation as a guard against bacterial build-up. In some instances the sows and litters are moved to open air housing in summer to allow proper disinfecting of the permanent houses.

The general trend in farrowing-pen design is to include some form of crate which will provide full control over the sow's movements at farrowing. Where separate farrowing- and rearing-pens are used, special crates, of both sparred and solid wall construction, have been developed to a most efficient degree, the most advanced being built within well-insulated houses equipped to maintain automatically a constant 70°F. Where the sow and litter are to be carried on to weaning in the same pen, various forms of hinged crate sides are used to retain the sows at the actual farrowing.

In contrast with the pens described above, which involve the enforced restriction of the sow, Mr. Norman Snell, in his Daylesford farrowing-pen, cleverly adapts the New Zealand Farrowing Ring "voluntary confinement principles" to the all-inside housing which is generally adopted in this country.

Whatever developments take place in farrowing-pen design, current experience suggests that it is unwise to save either capital expenditure or labour when to do so would involve any reduction in housing standards. Detail design can greatly ease management tasks in feeding, cleaning and the handling of pigs. Sows and litters have been kept in crates with side creeps up to eight weeks, and while this "most unnatural" system has not been proved it may be a pointer to things to come—pig-rearing batteries. In view of the proved value of isolating units in farrowing- and rearing-houses, it is most unlikely that any extensive form of group farrowing within permanent housing will be developed.

In the early stages of fattening, up to 120 lb, pigs are generally run in larger groups, often in yards and courts where they are fed *ad lib* from self-feeders. However, few strains of pig will provide the desired carcass quality if fed through to bacon on this system; some form of controlled feeding is necessary.

Details of modern design

This is not the time to attempt a detailed catalogue of all the feeding piggeries developed over the past ten years, but I will try to outline some of the important factors which they incorporate.

Greater care is being taken in siting piggeries in relation to local microclimatic conditions, and also in planning the unit in such a way as to reduce labour in deliveries and dispatches of materials and stock. Far more care than ever before is being given to the maintenance of the proper environmental conditions. Today, in many instances, far better insulation is being provided in piggeries than in domestic housing. While fair results may be attained by using natural ventilation, it is recognized that only fan-assisted airflow will give the necessary positive control. Mechanical ventilation allows much greater flexibility in house design; it can counter fluctuating exterior wind pressures, provide a varying airflow in whatever part of the piggery it is required, and ensure that airborne infections are not carried from one pen to the next. The same steps towards pen segregation, as previously mentioned in respect of farrowing-pens, are being increasingly adopted for feeding-houses, even when this involves extra labour mucking-out. However, the development of slatted-floored dung areas and sludge disposal systems allows segregation with less labour.

While all manner of steps are being taken to reduce labour costs and the old drudgeries, labour represents only some 12 per cent of the cost of producing a bacon pig, and any development which will help to improve feed conversion (80 per cent cost) is to be accepted.

Large pen numbers permit both reduced capital outlay and labour charges, but they are the exception rather than the rule. Where pigs are yarded, large groups are inevitable. To ensure that a piggery will hold the maximum number of pigs, so as to reduce capital costs and increase the body heat factor, pens of graduated sizes are used, and a 10-pig-pen house may include pens from six feet to ten feet trough frontage.

Trough layout reflects pen numbers in relation to building economy—large pen numbers have troughs at right angles to the main feed passage, small numbers have troughs flanking it. The glazed fire-clay trough with both rail and swing fronts is generally used. Various forms of mechanical feeding have been developed, involving overhead feed passes with direct gravity feed of whatever ration is required, mechanical hopper conveyors with automatic individual pen rationing, and the pressure delivery of wet feed in pipes. Fully-automatic systems will be slow in development, as most pigmen find feeding time the most suitable for observing their pigs. When this is borne in mind, there is much to be said for a feeder which comprises a hopper over the trough holding a week's supply of feed, with a manual, lever-operated let-down of the required ration. This reduces the labour in feeding and ensures regular attendance on the pigs.

Muck-handling

While various yard designs allow manure to pile up and be removed at intervals varying from a week to six months, they can be used only in those ever-decreasing areas where straw is plentiful. The sweep-through dung pas-

sage is used in conjunction with two- and four-wheeled tractor scrapers, as well as with built-in mechanical scrapers. The sludge handling of dung involving sawdust, shavings, other granular or no bedding has greatly reduced muck-handling, even where initial manual cleaning is involved. It is used either with open channels, patent baffled self-emptying channels, or with long, narrow holding tanks with direct outlet from every one or two pens. The slatted-floored dung pass of Norwegian origin offers a nearly self-cleaning arrangement when used with the self-emptying channel or continuous sludge tanks. It appears that 2 × 2-inch concrete slats set 1 inch apart may provide the most suitable flooring for this system, which is still in the development stage.

The planning of fenced runways (often portable sections), well planned weighing systems and loading ramps are being adopted as necessary time and temper savers.

Whilst the move towards complete automation of the piggery will continue, the animal health and stress factors will have to be rigidly respected. If "tranquillizer" feeding is developed, however, far more extensive systems than are at present practised may be feasible. The continued efforts of designers, in co-operation with the building trade, should lead to simpler, cheaper buildings.

Drinking Habits of Grazing Cows

D. S. MACLUSKY, B.SC., PH.D.

*Hannah Dairy Research Institute, Kirkhill, Ayr**

How much and how often do grazing dairy cattle drink? Is a constant supply of water in the field important, or would a supply in the milking shed suffice?

INFORMATION is available on how much water *housed* cattle drink, but little is known about the amounts drunk by dairy cows *at pasture*. Studies of the water requirements of housed cattle cannot apply to grazing cows; not only are the season and environment different under grazing conditions, but the nature of the food is different too.

Some information on the drinking habits of cows at pasture has been obtained in experiments at the Hannah Institute. In these experiments, small herds of Ayrshire milking cows were fold-grazed across ryegrass pastures in the usual way, except that each cow was separated from its neighbour by an electric wire.[1]

The yield and water content of the herbage available to each cow were estimated before and after each day's grazing, and each cow was provided with a tank of water, the contents of which were measured daily. In this way the consumption of herbage dry matter, of water contained in the herbage,

* Now at King's College, Newcastle-upon-Tyne.

and of water from tanks were estimated daily for each cow in the herd over several grazing periods of a week or so in duration.

Frequency of drinking

The results showed that the herbage eaten varied according to the yield of herbage per acre, the intensity of stocking, and the live weight and milk yield of the cows. The amounts of water which the cows drank from the tanks in a day were extremely variable. On wet days some cows drank little or none: on drier, warmer days, others drank as much as 10 gallons. The average amount drunk daily, at an average milk yield of about 3 gallons, was 5½ gallons per cow, and this was taken in an average of only four drinks. The number of drinks varied from one to six per cow in each 24-hour day. These figures represent the total number of drinks in the 24 hours, because during the experiments the water supply in the milking shed was cut off.

Considerable variation in the frequency of drinking is, of course, to be expected because of variations in the air temperature, in the dry matter content of the herbage, in the milk yield of the cows and because of individual idiosyncrasy. Reports in the literature[2] suggest that grazing cows usually drink from two to five times daily, and probably never more than seven times. Higher frequencies tend to occur with supplementary feeding, and the highest are shown by housed cattle.

In the Hannah Institute experiments, between two-thirds and three-quarters of the total number of drinks in the 24-hour period were taken during the evening grazing (from the afternoon milking to sunset). The cows often drank as soon as they returned to the field from the afternoon milking, but did not, generally, after the morning milking. During an intensive spell of grazing they often dipped their muzzles into the water tank without swallowing. These occurrences can be mistaken by the observer for drinks, but were not included in the frequencies of drinking quoted above for this herd.

Dry matter intake and water consumed

It was interesting to find that there was a fairly constant ratio between the amounts of dry matter eaten and the total amount of water taken in (that is, water contained in the herbage and from the water tanks). The ratio was about 1:7, which means that the dry matter content of the total daily intake was about 12 per cent. This proportion was smaller than those reported from winter feeding experiments,[3] which varied from 1:3 to 1:5. The difference can probably be explained by the fact that, at pasture, as much as 60–70 per cent of the water consumed is contained in the feed, and this generally causes an increase in total water consumption.

A fairly close relation between dry matter and water consumption is not unusual within any given feeding regimen, but it was interesting to find that it was so constant in grazing conditions, and that so little drinking water was consumed. For example, one experiment was conducted in the wet summer and autumn of 1953 with Ayrshire cows yielding on average about 3 gallons of milk daily; another took place in the early summer of 1954, with two cows yielding 2 gallons and two yielding 4 gallons. With the excep-

tion of one unthrifty cow, whose appetite was poor, in the first experiment, the ratio of dry matter to water in both was about 1 : 7.

The main reasons for this constancy were that the grass consumed was generally at the same stage of growth and, therefore, of about the same chemical composition. The maximum daily air temperatures were also much the same in these two experiments (about 65°F) despite the difference in season.[4] High-yielding cows, of course, drank more water than low yielders (about 1 gallon of water per gallon of milk, which incidentally implies that 2½ gallons were drunk for maintenance), but this did not alter the ratio materially because the high yielders also ate more dry matter. This is shown in the following table.

Amounts of herbage dry matter and water consumed daily by grazing cows

(Results of one experiment on four cows only)

Daily milk yield	*gal* 3–4	*gal* 1–2
	lb	*lb*
Fresh herbage	149	106
Dry matter in the herbage	27	19
Water in the herbage	122	87
Water from tanks	69	44
Dry matter as per cent of total intake	12·2	12·7
Ratio dry matter: water	1:7·1	1:6·9

Feeding 8 lb of supplementary concentrate per cow daily increased the ratio to 1 : 6, despite an increase in the number of drinks from four to five a day.

Although with cows there is a close relation between the amounts of dry matter and water consumed, there is some flexibility in the interval between the consumption of a dry feed and the time at which water is drunk. The times at which extra drinks were taken by cows fed supplementary concentrates in one of these grazing experiments were not related to the time at which the supplements were eaten. A closer connection between the times of consumption of a dry feed and of water is found when large quantities of a bulky dry feed such as hay are fed.

The rate at which water was drunk from tanks was measured in one experiment, and it was found that at each drink as much as 3½ gallons were sometimes taken, at an average rate of about 1 lb per second. This amount was 70 per cent of the average daily water consumption of cows at pasture, and at that rate of drinking the grazing cows could have consumed all their daily requirements in two drinks.

Because of the high rate and low frequency of drinking, and because the times at which water is drunk are apparently quite flexible (except for the drinks taken immediately after milking), the question arises whether a constant supply of water in the field is as important as it is generally supposed to be. Would the provision of water in the milking shed suffice?

Effects of restricting drinks

Reports in the technical literature on the effects of restricting the number of drinks cattle are allowed are available only for housed cattle fed mainly

on dry feed, and these animals may be expected to drink more often. From these reports it is evident that while heifers and dry cows can probably take all their daily requirements in one drink, two drinks a day must be regarded as the absolute minimum for housed milking cows; and it appears that a greater frequency of watering, or free access to automatic water-bowls, sometimes but not always increases water intake, milk production or rate of liveweight gain. These observations, however, may not apply to grazing cows which are taking in herbage water with every bite. Although the grazing cow presumably requires some of its water intake in the form of drinking water, as distinct from water in the herbage, the constancy of the ratio found between dry matter and total water intake suggests that in wet weather on succulent herbage the cows may be obliged to take more water than they require. Whether or not this would cause any physiological upset, or impair the efficiency of food utilization, is doubtful but, in these extreme conditions, dry matter intake would probably be reduced unless some dry feed were made available.

Although cows may in general be able to drink all they need when brought in for milking twice daily, the absence of water in the field may be expected to cause unsettled behaviour in hot weather, at any rate with cows accustomed to drinking at pasture; and cows with very high yields might not be able to take in all their requirements. When the weather is not hot and dry, or in dairy farming systems where low costs rather than record milk yields are the aim, it may not be as necessary as is sometimes thought to supply water to cows at pasture.

This observation may save considerable trouble when, for example, a herd is fold-grazed with a back fence. Of course, if cows are grazed without continual access to water, their drinking water should be supplied from a trough, and not only from automatic drinking bowls, which may not deliver water quickly enough to allow the animals to take all their daily needs in two drinks.

References

1. The Quantities of Herbage Eaten by Grazing Dairy Cows. D. S. MacLusky. *Proc. Brit. Soc. Anim. Prod.* 1955, 45–51.
2. Grazing Behaviour of Cattle. J. Hancock. *Anim. Breed. Abstr.* 1953, **21**, 1–13.
3. Nutritional Physiology of the Adult Ruminant. E. G. Ritzman and F. G. Benedict. 1938, Carnegie Inst., Washington, D.C.
4. The Water Economy of Farm Animals. I. Leitch and J. S. Thomson, *Nutr. Abstr. Rev.* 1944, **14**, 197–223.

Beef from Breeder to Butcher

K. MacLeod, B.Sc.

National Agricultural Advisory Service, Cumberland

A breeder of beef cattle, a feeder and a butcher, all well known to Lakeland farmers, exchanged opinions on beef production at a recent meeting arranged by the N.A.A.S. and the Keswick Farmers' Discussion Group.

THE EARL OF LONSDALE, a breeder with 350 beef cows on his 2,300 acres, thinks farmers ought to breed more beef. There is a good market and, he said at a recent discussion in Keswick, it is likely to remain good before the thirty years' leeway in home beef production is made up. He has herds of Beef Shorthorns, Galloways, Blue Greys and Hereford types, and chooses his bulls for length, frame and not too much bone. Beef Shorthorn blood gives his Herefords more bone, larger size and the milking capacity to rear a really good calf. He finds the Blue Grey, obtained by crossing Galloway cows with a white Shorthorn bull, to be the best nurse cow; and one which, crossed with a Hereford bull, can suckle a beautiful calf that makes £3 to £5 more than other crosses. And Blue Greys seem harder living than other types.

The dairy herd is an important source of beef. Lord Lonsdale said that on his 550-acre dairy farm, Dairy Shorthorns are crossed with a Hereford bull, to give splendid bullocks with a great frame. He thinks pure beef breeds require rather a fuss and palaver; the bull calves to be reared for service have to be removed at three months and boxed with a foster-mother—a perfect nuisance; but if a good trade for pedigree bulls has been worked up, it is probably worth while. Lord Lonsdale rears his beef stores very profitably by single suckling. The cost of keeping the Blue Greys lying out is about £22 to £24 a year: they need no supplementary feed and are wintered on hay, straw and silage. Their only extra requirement is minerals, of which they get all they want. Three hundred and fifty cows consume four tons of minerals a year, costing £320, and it is cheap at the price to keep them healthy. His cows live a long time; some are seventeen years old and can still produce a calf. They are bulled in lots of thirty-five, the bulls among them from 1st May to 1st August, and average 98 per cent calves. The suckler calves averaged £35 to £40 last year, and to that has to be added Calf and Hill Cow Subsidy.

Feeder's requirements

The feeder in this discussion, MR. TOM SCOTT, has until recently farmed some 750 acres at Broughton Moor. His feeding cattle were mostly Irish, and he had some advice to offer on the type of animal the feeder requires. Buy good cattle to start with, he said, and remember that the type is more important than the breed. The first cross is best for feeding. Ireland at one time was full of good, clean Shorthorn cows which had been crossed with Aberdeen-Angus bulls, and produced superb feeding cattle. Nowadays they

are breeding from first and second crosses and not getting the size they did formerly.

The Aberdeen-Angus bull crossed with something big—Friesian, Hereford or Shorthorn, for example—gives excellent weight for age, and this is what the feeder wants: it is profitable. He looks for conformation; a deep, well-proportioned animal with good hindquarters, beef well down, and good legs, not set underneath the animal but out on the corners, with plenty of length from hooks to pin bone, and a good loin. There lies the most valuable meat where the butchers like to see it.

A feeding beast must never have a store period: it should get a good start and never be allowed to stop. Mr. Scott said that it is surprising what can be done by judicious management of land, by keeping the fertility of the farm high. If the land is done well, it will acquire the properties necessary to feed cattle. For grass fattening, the animals should be bought in early and kept going on until the grass comes. If they have to be boxed in the autumn, they must be given time to get fat—they cannot be forced.

Butcher and public

The butcher was MR. JOE PARTINGTON of Whitehaven, a past president of the National Federation of Meat Traders Associations and a judge of beef from dairy cattle at this year's Dairy Show. He was puzzled, he said, to hear the other speakers admit that rearing and feeding are profitable, when feeders invariably come up to him in the market and say they are getting nothing out of their cattle.

The sort of meat he wants is not very plentiful, many animals bred from dairy herds having big briskets and long fore-ends. The butcher looks for good hindquarters, lighter forequarters, length for a good sirloin, well rounded and well fed-up breeches with an abundance of good steak. Too many cattle today fall away in the steakpiece.

The public come into his shops and say they don't want any fat. If he buys lean animals, they say there is something wrong with the colour—the meat is not bright enough. "What the public want," said Mr. Partington, "is lean meat off a fat animal! If I have got to cut off fat and put it into the fat bag, which is of very little value, I have to charge a bit more. That is why the housewife has to pay a little more for the meat she wants today—it's her own fault."

The butcher wants an animal which has been brought to maturity as quickly as possible. This produces the tender meat which the housewife loves. No two butchers' shops are alike: the demand in one is not the same as the demand in another, and the butcher has to buy animals to suit his particular trade. Sometimes large beasts make prices comparable to smaller, better animals because they are bought by those who have a contract trade. Such buyers require bulk, and many cattle fed to 11–12 cwt go to them; but the number of buyers who can handle carcasses of this weight is limited.

No fear of a glut

When the meeting was thrown open for discussion, several questioners expressed a fear of a glut of beef in the near future. Mr. Partington has no

such fear. Last year many more beef animals were being bred, and he expects these to come on to the market next year, but he considers it most unlikely that the market will reach saturation. Argentine chilled beef is not available in former quantities, nor is it likely to be. Australian, New Zealand and South African beef does not compare with that from the Argentine; neither does Argentine beef compare with what we produce at home: British beef is best.

"We have seen the bottom drop out of the mutton market," Mr. Partington continued, "not just because of over-production but because many of the lambs should never be graded. They are neither meat, washing nor lodging and are depressing the price of better-finished sheep. We butchers do not know what to sell our mutton at. If we bring the price down, we have the devil of a job to get it up again. We are hesitant to charge too little for it. Remember, too, we shall probably be paying 4*s*. a pound for it in February, as against 1*s*. 6*d*. today."

But a housewife in the audience was not impressed by Mr. Partington's "hard-up tale". Most women buy beef, she said, because it is more economical to use than mutton. The butcher weighs the bone and the customer has to pay for it: a fillet of beef at 5*s*. a pound leaves the butcher a very good profit. Mr. Partington did not agree. There is only, he said, three to five pounds of fillet steak in each beast and everybody wants it—they should expect to pay a decent price for it.

Fertilizer Practice Surveys

B. M. CHURCH, B.SC.

Rothamsted Experimental Station, Harpenden, Herts

Mr. Church describes the methods of fertilizer practice surveys in England and Wales, and illustrates the value of the results to farmers, the advisory services and industry by discussing results from a series of surveys in east Shropshire. He also summarizes some information on recent trends in cereal manuring.

SURVEYS of how farmers in England and Wales use their fertilizers were begun in 1942, and have been undertaken in various parts of the country during most subsequent years.[1] The field work has been undertaken mainly by the Regional Soil Chemists of the National Agricultural Advisory Service and also, during the last year or so, by representatives of the Fertilizer Manufacturers' Association. The success of these surveys, which were the first of their kind, has depended entirely on the co-operation of farmers who have given detailed information about their fertilizer practice. This article describes the survey methods and shows the value of the information obtained.

Fertilizer practice differs greatly from one part of the country to another,

and even quite locally; for example, on the Bunter Sands of west Nottinghamshire, 50 per cent more nitrogen and potash are used per acre than on the clay soils of east Nottinghamshire. Surveys are therefore undertaken within districts which are reasonably uniform in soil and farming type. Districts are surveyed either because they are of special interest, or because they are typical of one of the main farming types of the country. Even within such districts, individual farmers use fertilizers very differently and, to obtain reliable estimates of average practice, information must be collected from at least sixty farms.

The parishes within a district are listed, and the farms in these parishes are assigned to four groups, according to their crops and grass acreages. The farms to be surveyed are chosen at random from those in each size-group. The information required from each farm is too detailed to be collected satisfactorily by postal questionnaire, and arrangements are therefore made to visit each farmer when he can spare an hour or more; the success of the survey depends on obtaining his interest and co-operation, and if the time is inconvenient a return visit is arranged. Whenever possible, visits are made between haytime and corn harvest, or soon after harvest, when farmers can best remember what fertilizers they used on crops grown that year. Information is usually obtained from 95 per cent or more of the listed farms, and this assures that the results are representative of the district as a whole.

As there is no need for the surveyor to see the crops, the interview usually takes place in the farmhouse. The acreages of the fields and their cropping in the last two years are recorded, together with the type, method and rate of each fertilizer application during the current year. On farms with many fields, fertilizer practice is recorded for two or three randomly selected fields under each crop. In some of the surveys, information has also been obtained on crop varieties, seed rates, etc., and soil samples have been taken from a subsample of the fields.

Information on fertilizer practice for individual fields is more reliable and detailed than what might be learnt by asking each farmer in general terms how he manures his crops. For example, the detailed records may show that a farmer who normally top-dresses winter wheat has been unable to treat all the acreage, because of bad weather or other factors. Again, one can see how far manuring is influenced by previous cropping, and whether fields which are dunged receive different inorganic fertilizers from other fields.

Objects of the surveys

Before the second world war, virtually nothing was known about how farmers used fertilizers. An important stimulus for the first surveys was the need to assess the value of fertilizers as then used, since they had to compete with food imports for shipping space. These surveys, together with the results of field experiments, showed that fertilizers as used were a very productive import, but that available supplies could be used even more profitably.[1] In particular, insufficient phosphate and lime were being used on newly ploughed land, and allowance had to be made for the special requirements of such land in the fertilizer rationing scheme.

From the beginning, the surveys have been useful to the advisory services by showing how they could best direct their efforts towards improving

farmers' profits from fertilizers. Survey results have proved valuable material for discussion groups, enabling individual farmers to compare their use of manures not only with official recommendations but with the practice of other farmers working in similar conditions. In this way farmers have been encouraged to think about possible improvements in practice.

Between 1944 and 1957, nitrogen consumption increased by 70 per cent, potash consumption more than trebled, and there were also big changes in the use of phosphate fertilizers. Over the years the survey results have shown how farmers' practices have improved, and how changes in consumption have affected the manuring of individual crops. Information on the use of fertilizers and on recent trends in practice has been useful to the Government and to industry, by providing some basis for estimating future fertilizer requirements and their effects on crop yields. In 1957 the scope of the survey work was greatly extended, and surveys were undertaken in a total of forty-five counties, thus obtaining a more complete picture of fertilizer practice in England and Wales than had previously been available for any one year.[2]

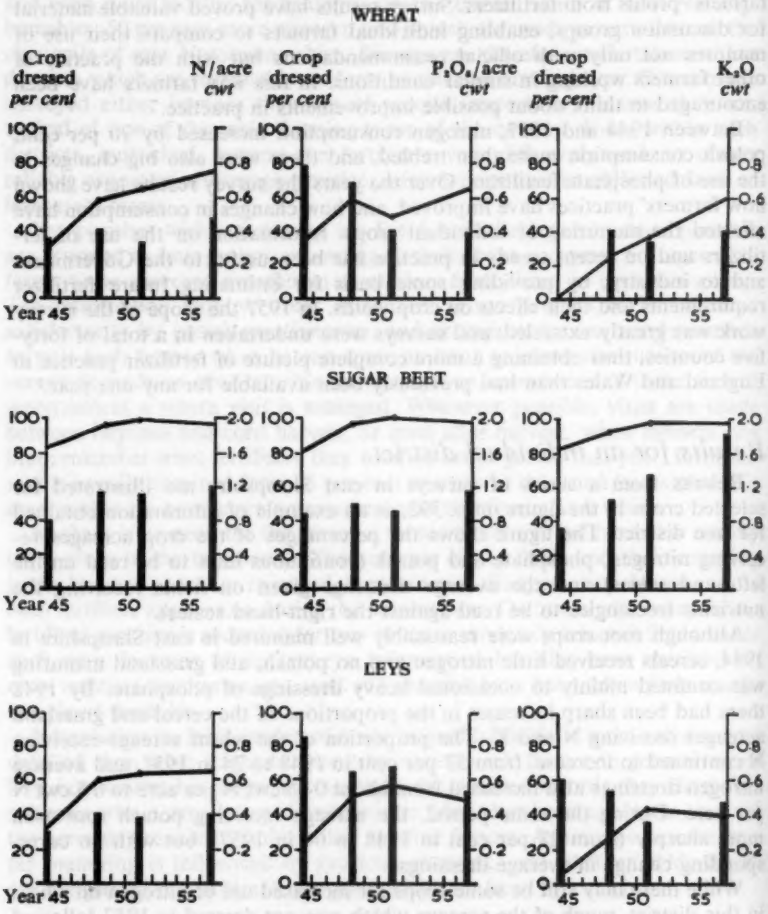
Results for an individual district

Results from a series of surveys in east Shropshire are illustrated for selected crops in the figure on p. 392, as an example of information obtained for one district. The figure shows the percentages of the crop acreages receiving nitrogen, phosphate and potash (continuous lines to be read on the left-hand scales) and the average dressings given on fields receiving the nutrients (rectangles to be read against the right-hand scales).

Although root crops were reasonably well manured in east Shropshire in 1944, cereals received little nitrogen and no potash, and grassland manuring was confined mainly to occasional heavy dressings of phosphate. By 1948 there had been sharp increases in the proportions of the cereal and grassland acreages receiving N and K. The proportion of the wheat acreage receiving N continued to increase, from 57 per cent in 1948 to 74 in 1957, and average nitrogen dressings also increased from about 0·35 cwt N per acre to 0·5 cwt N per acre. During the same period, the acreage receiving potash rose even more sharply (from 28 per cent in 1948 to 64 in 1957), but with no corresponding change in average dressings.

While there may still be some scope for increased use of nitrogen on wheat in this district, much of the acreage which was not dressed in 1957 followed heavily manured roots or leys, and any additional profit from heavier dressings would generally be small. This represents a striking improvement in practice over the last ten years.

Increases in the proportion of the wheat acreage receiving phosphate have been accompanied by a striking decline in average dressings, from about 0·7 cwt P_2O_5 per acre after the war to 0·34 cwt P_2O_5 per acre in 1957. These changes are associated with the greatly increased use of complete fertilizers as distinct from "straight" phosphate on cereals; in 1957 only about 10 per cent of the wheat received phosphate other than in complete fertilizers. In a well-balanced rotation, cereals are not very responsive to phosphate on most soils, and the present dressings must be fully adequate, especially as about half are combine drilled.



Lines to be read against scales on the left, rectangles against scales on the right.

Trends in manuring in East Shropshire, 1944–57.

Of the total cereal acreage, 20 per cent was grown after a previous cereal crop, about half after potatoes, sugar beet or fodder roots, and most of the remainder after grass. Table 1 shows that the residual values of fertilizers applied to roots and of ploughed-in grass were reflected in the average manuring of subsequent cereal crops. The proportions of the wheat and barley acreages receiving N, P and K were all substantially less when these crops followed roots or grass than for second cereal crops, and farmyard manure (FYM) was also used less after roots. However, when nutrients were applied the average dressings were little influenced by previous cropping.

Table 1

Influence of previous cropping on manuring of cereals in east Shropshire, 1957

		Previous crop					
		Cereals	Root crops	Grass	Cereals	Root crops	Grass
		Acreage dressed *per cent*			Average dressing* *cwt per acre*		
N	Wheat	84	75	71	·49	·48	·47
	Barley	84	55	45	·28	·23	·30
P_2O_5	Wheat	91	60	65	·33	·34	·33
	Barley	72	52	45	·41	·30	·25
K_2O	Wheat	91	57	65	·43	·43	·40
	Barley	72	52	45	·35	·35	·29
FYM	Wheat	17	8	9			
	Barley	9	0	11			

* on fields receiving the nutrient

Since the war, virtually all the sugar beet in east Shropshire has received complete fertilizers; the figure opposite shows that average dressings of N and P_2O_5 have increased by about 20 per cent in the last ten years, while potash dressings have doubled. About half the crop received FYM in 1957, but average levels of inorganic N, P and K manuring made little allowance for its nutrient content:

	cwt per acre		
	N	P_2O_5	K_2O
Without FYM	1·23	1·18	1·75
With FYM	1·10	1·04	1·65

This result is typical of the use of dung on root crops in many parts of the country.

Average nitrogen and potash dressings to sugar beet were at about the ideal levels in 1957, but the use of phosphate, at an average of 1·1 cwt P_2O_5 per acre, was considerably in excess of requirements. Recent experiments on fields in reasonably good heart in this district consistently failed to give any worthwhile response to phosphate. For the country as a whole, the average need is about 0·5 cwt P_2O_5 per acre and, except on deficient soils, no additional phosphate is needed on dunged fields.[3] Many farmers could profitably use less phosphate on sugar beet. This discrepancy between practice and current recommendations has underlined the need for compounds with a low content of P relative to N and K; these have recently become available.

Since the sharp increase in the use of N, P and K between 1944 and 1948, the main change in the manuring of leys in east Shropshire has been a further increase in the proportion receiving potash. In 1957, two-thirds of the leys received N, and about half received P and K. Some form of complete fertilizer was used on one-third of the acreage, and dressings of superphosphate or slag alone were exceptional. The proportion of the acreage receiving P has increased, but average dressings are smaller, because of the swing towards complete fertilizers.

It can be seen from the following table that, compared with the long leys, a smaller proportion of the one-year leys received fertilizers, and average P and K dressings were lower. Leys which were mown during 1957 received rather more N but similar P and K manuring to those which were only grazed. But of the acreage mown in 1957, only one-third was mown in 1956, and almost half followed tillage crops which had received complete fertilizers.

	Acreage dressed				Average dressing		
	per cent				*cwt per acre*		
	FYM	N	P	K	N	P_2O_5	K_2O
One-year leys	5	55	29	29	·41	·30	·43
2–7-year leys							
mown in 1957	13	81	56	47	·41	·51	·48
grazed only in 1957	5	60	55	44	·41	·55	·52

Experiments show that dressings of 0·2–0·4 cwt N per acre generally give useful increases in hay yields from mixed clover/grass swards; moreover, on leys cut repeatedly for dried grass or silage, responses increase almost in proportion to the dressings given.[4] Additional nutrients, in particular potash, must be supplied to replace those removed from fields which are regularly mown. It is easy to claim, for east Shropshire as for other parts of the country, that more fertilizers could profitably be used on grassland. However, much more experimental work is needed on the fertilizer responses of different swards, the long-term effects of nitrogen manuring at different levels on their composition and productivity, and the implications for P and K manuring, particularly on grazed fields.

Heavy manuring of grassland is justified only if the additional grass is used efficiently, and future surveys might examine how far other factors, such as farm buildings, available labour and stock management, limit profitable levels of grassland manuring.

Table 2

Use of fertilizers on cereals in different regions of England and Wales, 1953–57

	East Anglia and south-east England				The Midlands, Yorks and Lancs			
	Acreage dressed		Average dressing*		Acreage dressed		Average dressing*	
	per cent		*cwt per acre*		*per cent*		*cwt per acre*	
	1953	1957	1953	1957	1953	1957	1953	1957
N	93	96	·32	·42	62	72	·27	·30
P_2O_5	87	91	·34	·30	55	62	·33	·32
K_2O	76	88	·33	·41	44	56	·31	·37
	Lowland districts of north and south-west England				Wales and English uplands			
N	38	58	·21	·25	34	43	·22	·24
P_2O_5	48	64	·52	·36	52	58	·65	·52
K_2O	32	56	·34	·39	20	39	·26	·38

* on fields receiving the nutrient

Information for England and Wales

General reviews of fertilizer practice throughout England and Wales[1, 2, 5] and of the manuring of particular crops[4, 6, 7] have been made from time to time by bringing together results from several districts. Recent surveys provide much new information, and forthcoming papers will discuss the types of fertilizers used on different crops, methods and times of fertilizer application to cereals, and the manuring of potatoes in relation to experimental results.

As an example of information for the whole country, Table 2 gives estimates of the average cereal manuring in four regions for 1953 and 1957, based on repeat surveys of nineteen districts. Between 1953 and 1957 the small proportion of the cereal acreage in East Anglia and south-east England which did not receive fertilizers was further reduced, and elsewhere the acreage receiving N, P and K increased substantially. There was a large increase in average nitrogen dressings from 0·32 to 0·42 cwt N per acre in eastern counties, accompanied by smaller increases at a lower average level elsewhere. Average potash dressings increased from about 0·3 to 0·4 cwt K_2O per acre in all regions, partly because the potash content of some compound fertilizers was changed. By contrast, because of the adoption of complete fertilizers in place of "straights", average phosphate dressings were lower in 1957, particularly in regions where they had been heavy, and this trend must be expected to continue.

References

1. The Manuring of Farm Crops: Results of a Survey of Fertilizer Practice in England. F. YATES, D. A. BOYD and IRENA MATHISON. *Emp. J. exp. Agric.*, 1944, **12**, 163–76.
2. Fertilizer Practice in England and Wales, 1956–57. D. A. BOYD, B. M. CHURCH and MARY G. HILLS. *Emp. J. exp. Agric.*, in the press.
3. The Fertilizer Requirements of Sugar Beet. D. A. BOYD, H. V. GARNER and W. B. HAINES. *J. agric. Sci.*, 1957, **48**, 464–75.
4. Influence of Fertility Levels on Grassland Output. D. A. BOYD and W. J. LESSELLS. *J. Brit. Grassl. Soc.*, 1954, **9**, 7–15.
5. Recent Trends in Fertilizer Practice in England and Wales. B. M. CHURCH. *Emp. J. exp. Agric.*, 1952, **20**, 249–56.
6. The Manuring of Sugar Beet. D. A. BOYD. *J. agric. Sci.*, 1957, **48**, 477–80.
7. Cereal Manuring in England and Wales. B. M. CHURCH. *J. Sci. Food Agric.*, 1956, **7**, 711–21.

★ NEXT MONTH ★

Some articles of outstanding interest

SLATTED FLOORS FOR STOCK *by P. Buckler*

INTENSIVE GRAZING FOR SHEEP *by G. R. Dickson*

TULIP EELWORM *by A. Moore*

ELECTRONICS AND FARM PLANNING *by Christopher Barnard and Brian Camm*

Manuring Barley on Chalk

Nitrate of Soda v. Sulphate of Ammonia

H. W. GARDNER, B.A.

St. Albans, Herts

TRIALS with nitrogen dressings on spring barley have been in progress for several years on chalky soils at Pitstone Green Farm, near Tring. Responses have been well above those obtained elsewhere on non-calcareous soils. "Nitro-Chalk" was used in the trials, but on other parts of the farm sulphate of ammonia was the usual source of nitrogen. There was a suggestion that "Nitro-Chalk" was the more effective, perhaps because half of its nitrogen is in the form of nitrate.

This possibility has been tested in a long-term experiment on the same farm, in which three levels of ploughed-in straw were combined with three levels of nitrogen. In the wet summer of 1958 and the dry one of 1959, twelve plots were split at random and used for a comparison of nitrate of soda with sulphate of ammonia (NS and SA in the following table). In both seasons a very striking visual difference in favour of nitrate of soda became apparent, and persisted throughout the growing season. The results at harvest were:

Yields of barley

cwt per acre, 13 per cent moisture

	Without N	42 units N		84 units N		Average
		As SA	As NS	As SA	As NS	
1958	13·9	21·05	23·95	24·3	26·9	20·7
Difference		2·9		2·6		2·75*
1959	17·6	22·95	29·35	21·4	29·0	23·0
Difference		6·4		7·6		7·0†

* S.E. 0·68 † S.E. 0·67

42 units N = 0·42 cwt (47 lb) N, or 2 cwt SA or 2·6 cwt NS

Taking the two seasons together, the average superiority of the nitrate of soda was just under 5 cwt of grain per acre. The above-average response to nitrogen is also illustrated by these results: 42 units of nitrogen as nitrate of soda gave an extra yield of 10·05 cwt in 1958, and 11·75 cwt in 1959, over the plots without nitrogen.

Other trials near by, in the same field, have shown only trivial responses by barley to agricultural salt. In a 32-plot NPK-salt experiment in 1957, the average effect of salt in the sixteen possible comparisons was an increase of 0·3 cwt of grain per acre. In a similar trial in 1958, it was less than 0·1 cwt. On this field, therefore, the superiority of nitrate of soda over sulphate of ammonia cannot be attributed to its sodium content.

At present, the net cost of 42 units of nitrogen as nitrate of soda is 43*s*., and as sulphate of ammonia 21*s*. With barley at 20*s*. a cwt, an extra 1·1 cwt would just cover the difference; the additional yield from nitrate of soda was over twice this amount in 1958 and nearly six times as much in 1959.

The superiority of nitrate over ammonia has been shown for many years, in the case of winter wheat, on the famous Broadbalk Field at Rothamsted. There, over the forty-six years 1894–1939, a dressing of thirty-eight units of nitrogen as nitrate of soda gave an average of 2·8 cwt more grain per acre than the equivalent as sulphate of ammonia.

One other result from the 1959 experiment at Pitstone is worth recording here. The moisture content of the grain when harvested by combine was as follows, each figure being an average of twelve samples:

	Without N	With SA	With NS
Moisture (*per cent*)	19·36	18·34	17·56

The top dressings did *not* delay harvesting but, contrary to a belief which still persists, reduced the moisture content—nitrate of soda significantly more than sulphate of ammonia. This confirms similar results in many experiments over a period of ten years, reported in this JOURNAL.*

* Nitrogen Top Dressings of Winter Wheat. H. W. GARDNER, *Agriculture*, 1953, **60**, 233–8.

INCREASED PRICE AND SUBSCRIPTION RATES

We much regret that because of higher printing costs, the price of *Agriculture* and its subscription rates have had to be increased.

From 1st January, the price will be 1*s.* per copy (by post 1*s.* 4*d.*) and the subscription rates:

Home and Commonwealth	14*s.*	including postage
Foreign countries	15*s.*	

Current subscriptions will not be affected until they are renewed.

Dairy Show, 1959

27-30th October

GEORGE JARRETT

THOSE of us who are not dairy minded, and whose farming is more concerned with fat lambs, corn, and cattle destined for beef, must perforce look at the Dairy Show from a far different angle than those who are literally concerned with all the vital statistics of a dairy cow's personal life and perhaps have some vested interest in a particular breed.

I went to this particular event with an eye on the results of the beef from dairy herd classes. My interest had been whetted a little before the show when some Devon × Ayrshires had been demonstrated at a field-day held by the Devon Cattle Breeders' Society in Somerset, and we were told that the crosses were to be exhibited in these new Dairy Show classes. Such was the favourable comment aroused at the demonstration that these beef classes became my main interest. Never have I watched any judging with such avid interest.

Farming in Devon, I have a natural liking for the Devon breed, but I have no personal interest in pedigree nor in Ayrshires. But when I found that the first-prize steer was a Devon × Ayrshire from Langman Partners of North Cadbury, near Yeovil, and this same animal then took second place as reserve champion to Messrs. Chivers' Angus × Dairy Shorthorn heifer, well, this made the Dairy Show for me. I felt that a new era was being opened for the production of beef from the large number of Ayrshire herds with this use of a Devon bull.

Let us turn from the beef side of dairy farming to that concerned with the production of milk. Despite the fact that British Friesians succeeded in carrying off the coveted Bledisloe Trophy—who can begrudge it to this great breed in its jubilee year?—my own thoughts seem to centre round the fine show made by the Jersey breed, with that grand cow "Polperro" winning the Buckhurst Cup for the fourth time running. Although at heart I am a beef man, these Jerseys with their top-quality milk always seem to make a special appeal to me. Even if my native Devons do produce a better carcass, at least we are sure of some really good milk from these ladylike Jerseys.

Ayrshires certainly seemed to be making sure of their share of the limelight, from successful participation in the cross-bred beef section to the winning of the supreme individual championship by "Snowshill Marietta". This success made "Marietta's" breeder, Mr. John Bourne, the first Ayrshire exhibitor to win the supreme championship twice since the present trophy was first competed for in 1926.

Man cannot live by milk alone

The British Dairy Farmers' Association, who promote the Dairy Show, certainly believe that "man cannot live by bread alone", and add their weight to showing that neither can he live only on milk. They give us not just a full

range of milk, but also that little bit of beef plus some excellent bacon, butter and cheese, not forgetting a bright array of flowers as well. Then there were also the classes for poultry, with many of the exhibits doing their best to overcome a cacophony of Olympian noises, notably the clatter from milk bottling and washing machines on the ground floor.

Machinery exhibits seemed to be more for the milk distributors and ice-cream manufacturers than for the general dairy farmer. Whilst some of our best-known dairy firms were represented, somehow I thought they were overshadowed by the displays aimed at the manufacturing side of the milk business. There certainly seems to be money in milk, and the dairy farmer should take courage from the thought that his product attracts big business to such a great extent.

Pigs can interest some of us who do not have even the mildest of flirtations with the dairy cow. I was particularly interested in the Large White successes from Mr. Gordon Walters' Tringham herd, and found myself looking enviously at the imposing display of award cards. Once again the thought came to my mind that these top-ranking pig-breeders and exhibitors vie with the dairymen when it is a matter of vital statistics.

So much for some of the highlights of this year's show as they appeared to me. As a farmer, farming in one county and living in another where I have to buy milk from ordinary dairies, the thought uppermost in my mind was how pleasant it would be if the consumer could be sure of getting really good, rich milk in the bottle on the doorstep. One cannot help feeling that when the average housewife feels an irresistible desire to buy some more milk because of its quality and flavour, then many of our sales problems will be over. When the consumer thinks about milk in terms of quality rather than price, we shall be able to come away from Olympia feeling that the cream of the British dairy-farming industry is really reaching the customer. As a consumer, how I look forward to that day. As a farmer, I think of the rich milk we get from one solitary Devon cow and feel thankful that, unlike many thousands of consumers, I have a better chance of drinking really good milk.

I left Olympia, however, with a renewed respect and admiration for the skill and care which the breeders and herdsmen of all the breeds had bestowed upon their exhibits. And not only on the animals at the show, but also on their predecessors over many years which had made the 1959 successes possible. We cannot buy such skill, but we can humbly respect those who possess it and have made the British livestock industry so worthy of esteem from all parts of the world. So we returned to our own nondescript animals, who still try to serve us in their own humble way.

Oxford Farming Conference 1960

The fourteenth Oxford Farming Conference will be held on 4–6th January 1960, at the Town Hall, Oxford; not in the Playhouse this time.

Further details, and tickets, can be obtained from Mr. M. H. R. Soper, University Department of Agriculture, Parks Road, Oxford.

Poultry Equipment in Russia

R. COLES, M.SC.(AGRIC.), M.SC.(ECON.), B.A., PH.D.
Ministry of Agriculture, Fisheries and Food
and
R. F. GORDON, D.SC., M.R.C.V.S.
Houghton Poultry Research Station

Novel designs of house, with unconventional siting of the nests, an ingenious egg-collecting machine, and a simple, reliable trap nest are among some useful ideas which the writers brought back from Russia.

WE visited Russia not long ago to investigate recent research work at poultry centres, and in the course of the tour saw several State farms. On some of these, the entire holding is given over to a massive poultry enterprise and the holding is, with some justification, called a poultry factory. For the most part, the housing and equipment follow the conventional pattern adopted in this country and elsewhere where poultry-keeping is a specialized business. But there were certain novel designs, and pieces of equipment showing considerable ingenuity, which might be of value in this country—either in their present form or with some adaptation.

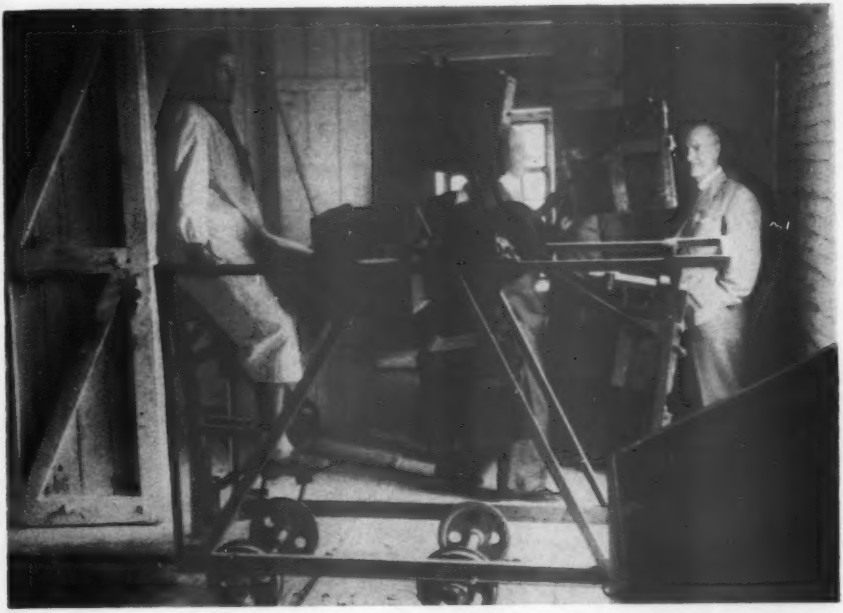
In the south we saw a house, very much akin to our strawyard, which has been designed to combat the effect of the hot climate of that area. The basic pattern is similar to a deep-litter house with a central corridor, but the roof extends only about half-way across the areas occupied by the birds on either side of the corridor; and where, in a normal deep-litter house, there are side walls and the continuation of the roof, there is only wire netting. The essential point of difference is that the "floor" on either side of the corridor is constructed of slats raised about three feet from the ground. The house looks like a strawyard raised three feet above the ground, and having slats in place of the customary earth floor, on either side of a corridor.

The advantage of this house in the Russian south is that it allows air to circulate and induce a cooler ambient temperature among the birds, much cooler than would have been the case with the more usual earth or cement floor. The droppings can also be removed frequently from under the slatted floor by long rakes. Egg collection and feeding are effected from the corridor, and water is supplied by automatically-controlled troughs in the house. We think a similar house might be introduced into this country—particularly among those who are convinced that open air is of value to the bird and, for this reason, do not like the normal deep-litter house. The absence of any need for litter also seems an advantage, since litter is fast becoming scarce and expensive in some parts of this country.

Novel nest layout

Another novelty in housing design is the siting of the nests in an otherwise conventionally-designed deep-litter house. This house has a central corridor and a fairly wide span—about forty-five feet. Three banks of food troughs

Poultry Equipment in Russia (Article on pp. 400–2)



This machine is driven along the corridor of the deep-litter house, and the operator takes eggs from the nest roll-aways and places them in the boxes, which she can move round.

Almost foolproof, swing balance trap nests at the Adler Poultry Factory, by the Black Sea.

Photo: *Commercial Camera Craft*

Weighing the lamb at birth.

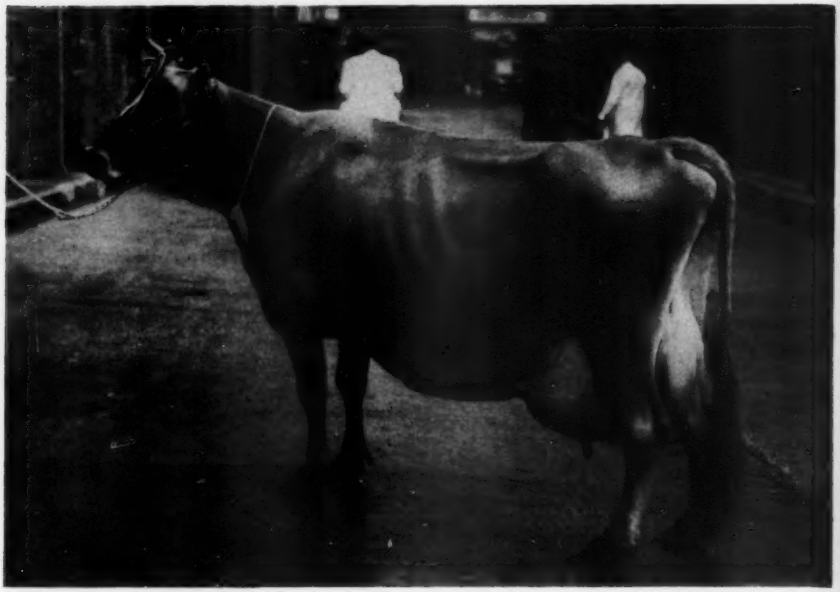
on pp. 410–3)

The ewe and her lamb are marked with the same number. A ewe with twins bears the number of the last lamb born.

Photos: *Commercial Camera Craft*

Plastic ear tags are probably less irritating than metal ones; and different colours may be used to identify the age groups in the flock.

Dairy Show, 1959 (Article on pp. 398–9)



"Polperro", the grand Jersey cow that won the Buckhurst Cup for the fourth time running.

Photos: *Farmer and Stock-Breeder*

This year-old Devon × Ayrshire steer took first prize in the cross-bred beef section, and was then reserve champion to an Angus × Dairy Shorthorn heifer.

project into the corridor. They are fairly high up, the lowest being about three feet above floor level and the highest about five feet. The space immediately below the troughs on the chickens' side has slats, with wire underneath them, extending to the ground and forming a droppings pit which can be cleared from the corridor through upward-lifting doors. Above this pit, which runs the length of the corridor in both sections of the house, are a series of roosts to allow the birds to reach the food troughs through grids in the wall. Finally, above the food troughs are the nests running the full length of the house—the birds gaining access to them by the roosting bars mentioned above.

The floor of the nests also projects a little way into the corridor; the back of the nest (forming part of the corridor wall) does not extend to the floor of the nest, and so enables the egg to roll out. This space is hidden from view on the corridor side by a short curtain, running the full length of the house and just reaching the level of the "roll-away". The egg when laid rolls out under the curtain—the latter preventing light entering the nest.

Egg collection and feeding

The roll-away is, of course, placed some five to six feet above the floor of the corridor and cannot easily be reached by persons of normal height. For egg collection in this house, and also for rapid feeding, the Russians have evolved two ingenious machines. For the first task they have a four-wheeled vehicle, operated by a girl working the back pair of wheels through a pedal and chain arrangement rather like a tricycle. She sits at a good height on the vehicle and can easily collect eggs from the roll-aways on either side of the corridor. She can also easily put her hand under the short curtain into the nests.

Within the body of the vehicle, immediately in front of the operator, is an arrangement of rotating struts, something like a small Ferris wheel, with a 15-dozen, wooden egg-box held in each of the five arms. The metal framework holding the egg-boxes also has a slot beside each box for the egg trays. The operator turns a handle to bring any box in front of her, and fix it temporarily in that position; the Ferris wheel principle allows each box to be rotated with its open side always upwards. The girl pedals the machine along the corridor, filling the egg-boxes directly from the nest roll-aways. As one box is filled, a short turn with the wheel handle brings an empty box in front of her.

This same house has an electrically-propelled carrier to fill the food troughs. We should explain that dry mash feeding is rare in the U.S.S.R., because of the emphasis on vegetables and green food (fresh or silaged) in their poultry diets. With a high proportion of chopped carrots, green corn, turnips, and grass, together with a variety of grain, dry mash feeding is virtually ruled out, and its absence is an obstacle to the development of automatic feeding. The wet or damp mixture generally fed is normally distributed by hand.

In the machine mentioned, the body of the vehicle has a food container from which the damp mash is propelled by worm wheels up into three large tubes on either side. The exit mouths of these tubes hang just over the treble banks of feeding troughs when the machine is driven down the corridor. The

operator, standing on the back step of the machine, controls the speed of progress and rate of delivery by a series of switches. The girl in charge sends the machine whisking along the corridor at an alarming rate, with wet mash jetting from the six spouts. The birds withdraw their heads from the troughs as the machine approaches and resume feeding as soon as it has passed!

The Russian emphasis on the value of green food in the diet of the fowl is again apparent in some of the breeding-pens. Their usual breeding-house is constructed on the lines of a deep-litter building, with a pop-hole from each pen leading to a wired-off run. Because of the long winter snows in the north and the long, hot and dry southern summers, grass is not a good crop in the U.S.S.R. In some of the breeding-pens we saw, the green food fed in the mash was supplemented by trays of sprouted corn in the pens. These trays, about four inches deep by two feet by two-and-a-half feet, are rested at an angle against the wall of the pen. The corn is usually some five or six inches long, and appears to be heavily grazed by the stock.

Foolproof trap nests

Some ingenious trap nests are worthy of comment. They are made of plywood, basin shaped and fitted in the usual square front of the nest. When at rest with the nest empty the concave side is outwards, and at the lower edge a hole is cut, about the size of a safety match-box. The bird entering the nest thrusts its head into this hole and, as it continues to enter, the nest-front pivots on the two side bearings to "cup" it into the nest. At this position of rest with the bird inside, the front shows the *convex* side outwards, with the hole at the upper edge. The bird can push its head through, but cannot get out because the nest-front does not pivot the full circle on its bearings. To get the bird out, the front has to be raised and rotated *backwards* to its original position; the movement partially "cups" the bird out of the nest. Small pressures do not open or close the nest-front, as it has to travel through at least 90 degrees before it passes the balance point and is shut or open. The passage of the bird's body inwards ensures this; so does the operator's hand in lifting it later. This nest-front seems more foolproof than many trap nest-fronts seen elsewhere.

Recording

It is customary in this country to have niches in the corridor walls in deep-litter pens where pedigree stock is being recorded to hold a tray containing the day's eggs. In some of the Russian houses this niche or shelf is replaced by a shallow drawer, in which there is a tray with a series of numbered holes. Eggs from nests are placed in the hole marked with the leg-band number of the bird. At the end of the day, the recorder walks the length of the corridor and enters the eggs laid direct into the record book; a girl follows behind and, after recording, packs them directly into boxes. The method seems a useful one when pullets are being recorded for production, but has no apparent advantages where eggs are being set, since there is no obvious way of overcoming the need to mark eggs for setting with the layer's number.

Principles of Glasshouse Heating

L. G. MORRIS, B.SC.(ENG.)
National Institute of Agricultural Engineering

Mr. Morris outlines the problems of glasshouse heating, and describes some of the latest ways of overcoming them, including the use of collapsible polythene tubes.

GLASSHOUSE heating consists essentially of replacing heat losses in such a way that the air temperature remains within the desired range over the whole of the glasshouse area. There are several ways of replacing heat loss, but the causes of it are always much the same.

By far the greatest loss occurs through the glass itself and, since glass is not appreciably transparent to the radiation from plants, soil and heating pipes, the heat passes almost entirely by conduction. It arrives at the inner surface of the glass by convection, radiation and, sometimes, by condensation of moisture, and it leaves the outer surface mainly by convection or radiation but sometimes by the evaporation of rain and the melting of snow. This heat loss through the glass is resisted mainly by layers of still air adjacent to either surface, which insulate far better than the glass itself. For this reason, heat is lost much more quickly when there is air movement inside or outside the glasshouse. The heat lost by radiation to the sky is not, of course, affected by wind, but is greatest when the sky is clear and relatively small when it is overcast.

Another source of heat loss is due to the interchange of air through cracks round ventilators and at glass overlaps. When the ventilators are closed, small cracks may become sealed by condensed moisture, but the heat loss due to this unwanted ventilation can amount to ten per cent of the total loss, or considerably more if the vents are not properly closed. Again, this tends to increase in windy weather.

Heat is also lost by conduction into the soil. During the course of a heating season this is a negligible proportion of the total, but the soil has a large heat capacity, and when the heating system is first turned on to warm the beds to the required temperature before planting out, up to ten per cent of the heat supplied may pass into the soil.

For the practical purpose of assessing heat losses, this complexity is usually simplified by making certain assumptions which are only approximately true. The rate of heat loss is assumed to be proportional to (1) the "temperature lift", or difference of temperature inside and outside the house, and (2) the effective area of glass, which includes the area of the glazed part of the structure and half the area in elevation of the brick walls. The heat transfer coefficient, which is the rate of heat loss divided by each of these two factors, is expressed as B.t.u./hr per °F of temperature lift per sq. foot of glass area (B.t.u./ft²hr°F). The magnitude of this coefficient depends on weather conditions and the degree of exposure of the glasshouse, and can have values which usually lie in the range 0·75–1·40 B.t.u./ft²hr°F. Much of this variation is due to wind; in fact the heat loss in a 12 m.p.h. wind is about twice that in

still conditions, which suggests that a shelter-belt on the windward side of a glasshouse nursery could be of considerable value. For the purpose of design, severe conditions must be allowed for, and it is usual to assume a heat transfer coefficient of 1·4 B.t.u./ft²hr°F. For the estimation of expected fuel consumption, on the other hand, an average value is required, and may be taken to be 1·1 B.t.u./ft²hr°F, although this is rather dependent on the amount of sun heat received in the glasshouse.

Temperature lift required

At first sight, it would seem easy to determine the required temperature lift, which must be decided before design can begin, but in fact this involves a considerable amount of guesswork. In the first place, the temperature requirements of glasshouse crops are by no means well established, although the seriousness of this uncertainty has only recently been appreciated. Secondly, whilst it would be widely agreed that the temperature may be allowed to fall below the "desired value" during the coldest weather, the magnitude of this fall is a matter of opinion. Since meteorological data are usually available, the temperature lift could be decided if we knew enough about the effect of temperature on the size, quality and earliness of the crop in question. Research into this question has been started, for the tomato crop in the first instance, by the N.I.A.E. and the N.A.A.S. Experimental Horticulture Stations, but the problem is immense and evidence will take several years to accumulate.

Heating by hot pipes

Most commercial glasshouse heating systems use hot pipes in some form. The traditional system used 4-inch-diameter cast-iron pipes through which hot water flowed by natural circulation, due to the difference in density of the hot water leaving the boiler and the cooler water returning to it. Among the advantages of this system were simplicity, the small resistance to the flow of water in the large-diameter pipes, and the large quantity of water, which limited the fluctuation of temperature resulting from uneven hand-firing of the boiler. On the other hand, the disadvantages, which have become more prominent in recent years, were the need to site the boiler below ground level to obtain good gravity circulation, inefficiency with regard to fuel and labour, and cumbersome pipe work restricting labour in the glasshouse. This type of system is now out of date except for small glasshouses and, as a result of the availability of electricity and the increased cost of fuel and labour, the use of automatic firing and pumped water circulation has become common practice. Also it is usual for steel pipes of small diameter to be used in new heating systems, although it must be admitted that some of the finest tomato crops are produced by the skilful Guernsey growers who use 4-inch pipes.

The advantages of small-diameter steel pipes compared with 4-inch pipes are lower cost for a given heat output, smaller water capacity resulting in faster response to automatic control, and greater versatility in design. The heat output of a heating pipe, which depends on its length and outside diameter, its temperature and the temperature of the air surrounding it, can be calculated with accuracy. This information, together with the estimated heat

loss of the house, enables one to find the amount of piping required. But the length of pipe is often determined to a great extent by the way the crop is arranged in the house and, if the pipe diameter is a matter of choice, the pipe layout may be made to suit the desired cropping layout. If the 4-inch pipe must be used, it may be difficult to design a good pipe arrangement which fits in well with a satisfactory crop layout.

An example of a heating system designed to suit the crop being grown is the small pipe system for tomatoes which was first used by the N.I.A.E. at Silsoe. The tomatoes are planted on the "Guernsey system", that is in pairs of rows running the length of the glasshouse, with footpaths between the pairs. The rows of a pair are about 18 inches apart, and there are six double rows in a house 30 feet wide. The heating pipes are placed near soil level down the centre of each pair of rows, but instead of using a single 4-inch pipe as in Guernsey, two 1¼-inch pipes are used to form a close loop, in which the water flows along one pipe and returns along the other. With this close loop, the fall in temperature along the length of one pipe is balanced by that in the other, so that the two pipes together give a heat output which is practically uniform along their length. Also, since all the plants are the same distance from a heating pipe, they should all receive the same temperature conditions. The heating pipes are connected to the mains at one end of the house by lengths of rubber hose and pipe clips, so as to provide a cheap, flexible and quickly detachable joint. The pipes are thus easily lowered on to the soil for soil warming, or raised up on bricks or other suitable supports for the main heating season. They may also be easily disconnected and suspended from the glasshouse structure to allow clear access for soil preparations. Sufficient pipes are also provided on the side and end walls to allow for the heat losses through the vertical glass.

Positioning the pipes

There are other considerations which may also affect the choice of pipe arrangement. With gravity circulation, some of the pipes are commonly suspended above the crop, to improve water circulation by increasing the height of the heating surface above the boiler. High pipes are also favoured by many flower-growers, in the belief that healthier, better-quality blooms result. Also, in the cold climates of Scandinavia and Poland, where temperature lifts are two or even three times those used in Britain, many more pipes are required and some of them at least are mounted high up to prevent dangerous accumulations of snow.

Variations of air temperature over the floor of the glasshouse depend on the arrangement of pipes. Obviously, some heat must be applied on the walls to avoid cold areas. Also, if all the heat is applied high above the crop, vertical temperature gradients are likely to develop, with cool, stagnant air near soil level. This can be avoided by inducing the formation of convection currents in some way. For example, if all the heat is supplied near soil level, the heated air is bound to rise and form a convection pattern. If the heat is supplied uniformly, or nearly so, over the area of the soil, the tendency is to promote large, slow-moving circulations or cells of convected air, which result in temperature variations along the length of the house, in a range of perhaps 5°F, which can persist for a whole night. If, on the other hand, all

the heat is applied low down on the side walls of a single-span house, a quicker, small-scale circulation is set up which results in very little variation over the area of the house.

This raises problems which are still being investigated at the present time: for example, the extent to which localized heating of plants and soil is required; the determination of the most economic temperature for a given crop and the permissible departure from this ideal; and the proportion of heating surface which must be transferred from the soil to the side walls to keep the temperature within the desired limits.

Methods of heating the pipes

The traditional method has been to circulate hot water from a cast-iron boiler at atmospheric pressure, and water at that pressure is still most widely used although the source of heat may be different. Nowadays a wide variety of hot-water boilers are in use. Alternatively, the water may be heated indirectly from a steam boiler, using medium-pressure steam in a heat exchanger or low-pressure steam injected directly into the water through a simple perforated pipe developed at the N.I.A.E. In the latter case the steam is injected for heating only, but in a limited number of large heating systems using 4-inch pipes, medium-pressure steam is forced in by special injectors which help to circulate the water in addition to heating it. This method is not entirely satisfactory because it is not possible to maintain a sufficient circulation rate when the heat output is low. The use of steam as the source of heat is particularly attractive on large nurseries owing to the relative ease with which steam can be conveyed over large distances. To have steam at medium or low pressure available in each glasshouse is also of great value for the steam sterilization of the soil.

Higher pipe temperatures and, therefore, smaller pipes, may be used if the water is heated under a pressure sufficient to prevent boiling at a relatively high, thermostatically-controlled temperature, and a boiler designed for steam-raising may be used for this purpose. It is also possible to lower the water level in the boiler and produce steam for soil sterilizing when required. This is a good method, although not commonly used, but it is probably outdated by the N.I.A.E. injector.

A further method resulting in high pipe temperatures is to use low-pressure steam in the pipes and, after draining the resulting condensate through steam traps, to return it to the boiler. With this system, which provides steam for soil sterilization and is not expensive to install in the house itself, the main difficulty is to obtain sufficiently good temperature control in time and space. However, the low-pressure steam system, if designed by a specialist, can give satisfactory results.

Other ways of heating

In recent years other ways of directly heating the air have been tried, with varying success. The simplest method is to use an automatically-fired air heater standing as a unit in the glasshouse. To be at all effective the air being heated must be forced through the heat exchanger, and directed horizontally above the crop along the length of the glasshouse. This can be done with a

number of commercially available units of high efficiency designed for factory heating. Unfortunately, the method results in excessive temperature gradients vertically, with low temperatures near the plants where the heat is required, and very high temperatures near the glass where the heat loss takes place. It is therefore not suitable for general glasshouse use, and the high heat loss offsets the high efficiency of the unit itself.

One way of making unit heaters more effective is by passing the heated air through transparent ducts, about eight inches in diameter, made of thin polythene, which are kept inflated by the pressure of the hot air. These are placed on the soil between rows of plants, and provide heat where it is required partly by convective heat loss from the surface of the duct (there is no radiative loss), and partly by jets of hot air issuing through holes in the polythene. This system has the advantages of low capital cost and portability compared with piped heating systems, and is particularly useful for mobile glasshouses and houses requiring heat for a relatively short period. Very little is yet known about the design of such a system, and uniform temperatures can be obtained only by trial and error.

Finally, electricity may be used to heat glasshouses. It has great attractions in ease of control and flexibility in design, but the relatively high cost of electrical heat at present makes it uneconomic for large-scale commercial use. The transmission of sufficient power for a large glasshouse is another problem. If the price of electricity can be considerably reduced in the future, this method of heating is sure to become more widely used.

Improvement of Horticultural Production and Marketing

MEASURES which the Government propose to take for the improvement of production and marketing of horticultural produce in the United Kingdom were published in a White Paper (Cmnd. 880)* on 5th November 1959. They comprise the introduction of grants, the establishment of a Horticultural Marketing Council for Great Britain with powers to undertake a programme of activities to improve the efficiency of the horticultural industry as a whole; and the setting up of a Covent Garden Market Authority for the purpose of reorganizing and improving Covent Garden Market.

A Horticulture Bill to authorize the introduction of a scheme of grants and to establish the Horticultural Marketing Council, on the lines set out in the White Paper, has been presented to Parliament. A separate Bill dealing with Covent Garden will be introduced later in the Session.

Improvement grants

Details of the Government proposals for grants to horticultural producers to improve their efficiency, especially in marketing, were given in Section II

* H.M. Stationery Office, price 9*d*. (11*d*. by post).

of the White Paper. The main feature is the Horticulture Improvement Scheme, under which direct grants will be payable to growers and their co-operative marketing associations.

To qualify under this scheme, a grower's business must comprise not less than four acres of open land, or its "equivalent", which for at least two years has been used for producing horticultural crops (fruit, vegetables, mushrooms, flowers, herbs, seeds, bulbs, trees and shrubs—but not hops, maincrop potatoes, or peas for seed or processing). To calculate the "equivalent" in terms of open land, the area of glasshouses, mushroom houses and rhubarb sheds will be multiplied by twenty, and the area under glass lights (including cloches) or used for growing watercress will be multiplied by four; any area used for growing annual vegetables in the open may be counted, provided that more than two successional horticultural crops have been grown on at least half of it in the two-year period.

Co-operative associations will be able to benefit under the scheme if their purpose is to help horticultural producers market their produce. An association must either be registered under the Industrial and Provident Societies Acts or have a written constitution which proves that it is in substance a co-operative association.

Grants will be payable at one-third of the cost of providing or improving specified buildings, plant and equipment for storing horticultural produce and preparing it for market, for example, by washing, grading, packing—but not processing or preserving. In addition, growers will be able to obtain grants for long-term improvement works of the kind assisted under the Farm Improvement Scheme, and for improvements to existing glasshouse heating systems. In general, grants will not be payable for the provision or replacement of glasshouses, but will be available for growers with between four and seven acres of open land (or its "equivalent") to enable them to bring their glasshouse area up to a total of 675 sq. feet.

Preparations are being made for the scheme to come into effect on 1st April 1960, subject to Parliamentary approval. Unless extended by Parliament for a further year, its duration is limited to five years.

Subject to the passage of the Bill, a draft of a statutory instrument, embodying the scheme set out in the White Paper, will be submitted to Parliament for approval in the early part of 1960. Preparations are being made for applications under the scheme to be accepted as from 1st April 1960. Further information about the scheme will be issued by the Agricultural Departments nearer that date. The Bill seeks Parliamentary authority to expend £8 million on new grants. Of this total, up to £100,000 will be available for grants to central co-operative organizations carrying out approved programmes for developing the co-operative marketing of horticultural produce.

Horticultural Marketing Council

In agreement with the main interests concerned, it is proposed to establish a permanent Council for Great Britain representing each of these main interests, together with a chairman and other persons from outside the industry. Part II of the Bill provides that the Council shall consist of twenty-eight members, of whom seven will represent the interests of producers; seven will represent the interests of importers and wholesalers; seven will represent

the interests of retailers; three will represent the interests of workers in the industry; and four will be persons from outside the industry. The composition of the Council may be varied by Order by Ministers after approval by Parliament.

The Council will have wide powers to enable it to compile and disseminate information, particularly information about supply, demand and prices; to encourage grading and standardization; carry out research and give advice on matters affecting marketing and distribution; and to carry out publicity and advertising. The Council will not have any regulatory powers or any trading powers except for experimental purposes.

It is the intention that the Council's activities should be financed by the industry, but the Government are proposing that finance for its first two years of operation should be provided from public funds, up to a maximum of £250,000 in all. During this initial period it will be the task of the Council to work out a system of industry-finance acceptable to all sections of the industry. Under the provisions of the Bill, any scheme for this purpose drawn up by the Council will have to be approved by Parliament and confirmed by Order by Ministers before coming into effect.

To meet the special interests of producers in promoting sales of their own produce, provision will be made to enable a body representative of British producers to be established for this purpose after approval by Parliament. Such a body would be financed by producers with money raised from them through the Council.

Covent Garden

The legislation to set up a Covent Garden Market Authority will provide for the Authority to take over and operate Covent Garden Market. This Authority will have the task of improving the facilities of the market, and of reducing traffic congestion and the risk of fire by providing a storage depot for empty containers and bulk produce outside the market area. Later on, and in consultation with the L.C.C. as local planning authority, the Market Authority will build new premises.

The Authority will be given powers to control and regulate the use of premises for market purposes in the area around Covent Garden, but in exercising them it will be required to act in close association with the traders who will be affected.

It will be expected to be self-supporting, but will obtain a limited amount of initial capital from the Exchequer for repayment with interest within a prescribed period. Any additional capital will have to be obtained from commercial sources.

The legislation will also make provision for a London Horticultural Markets Consultative Committee to be established. This will provide a forum for discussion where representatives of owners and tenants of the London markets can jointly examine proposals for substantial alteration or development of any of the markets. The Committee will have no executive functions, but will advise the Minister on matters falling within its term of reference.

Sheep Recording

H. F. FIELDSEND, B.SC.(AGRIC.)
Dorset Farm Institute, Dorchester

How the Dorset Farm Institute mark their Dorset Horn sheep, what they record, and the benefits they expect from recording are outlined in this short article.

THERE is little doubt that good flockmasters have been recording their flocks over the centuries, otherwise our breeds of sheep would not have attained their present excellence. The recording of yesterday, however, and the recording of tomorrow must be very different in technique. The old flockmasters recorded very largely by eye, experience, and probably often merely by gifted intuition. Many of them got results, it is true, but if more people today measured the excellence of their sheep by keeping comparatively simple records, the standard of flocks in the country as a whole would surely improve.

We have been recording our flock of Dorset Horns here at the Dorset Farm Institute for only a short time, but we hope that our experiences in the field may be helpful to intending flock recorders.

Commercially, the profitability in any flock depends on the number of lambs born and weaned, and the milkiness of the ewes, which in large part will control the rate of liveweight gain of the lambs. These are the most important factors to record, but recording will also help good management in other ways. To give only one example—if ewes cannot be identified apart, how can any progress be made by knowing with certainty which ram was the father of their lambs? Wool is also important and can be recorded; any deficiency of quality and quantity then becomes more evident.

Identifying the ewes

The first step is to ensure that every sheep is easily recognizable. Methods used to identify the ewes are ear notching, tattooing the inside of the ear with numbers or letters, and using numbered plastic ear tags.

In ear notching, every notch has a fixed value. A notch out of the tip of the left ear can be 3, one about half an inch down from the tip 2, and one further down the top of this ear, 1. At the bottom of the same ear, notches opposite 2 and 1 can represent 4 and 5 respectively. In the right ear, notches in the correspondinng places can represent tens—one at the tip would be 30, and so on. For example, ewe number 36 would have a notch out of the tip of the right ear, and the 5 and 1 notches out of the left ear. A hole punched in the centre of the left ear can represent 100. But if the right ear is punched there may be confusion with the certification marks under the Fatstock Guarantee Scheme. It is best not to notch or punch the certification ear at all, if this can be avoided. Any animal presented for the fatstock guarantee payment may be rejected, on the ground that it may already have been certified and ear-punched, if part of its right ear is missing.

Numbers or letters tattooed inside the ear also are often unreadable, and they take a long time to read when the ears are dirty and have to be cleaned before the numbers can be seen.

Here we use numbered plastic ear tags, inserted in a hole punched in the centre of the left ear. These tags are easy to read and do not seem to worry the ewes, though some have lost them in the course of a year, and the ideal might be to have all ewes tagged in one ear and tattooed in the other. Although plastic ear tags are probably less irritating than metal ones, we have found that they irritated some of our ewes. Our shepherd has suggested that when we mark the next bunch, we punch the holes and then leave the wounds to heal before we insert the tags. The use of different-coloured tags to identify quickly the age groups in a flock is a practical variation from using one colour, and easier than looking at their teeth!

Numbering the lambs

As each lamb is born, it is numbered on the flank with marking fluid, starting at 1 and just carrying on in succession until lambing is completed. At the same time, the ewe is marked on the hindquarter with the same number as the lamb if a single; a ewe with twins is marked with the number of the *last* lamb born. For example, if the first ewe in the flock lambs a single, then both ewe and lamb are marked 1; if the next ewe lambs twins, then the lambs are marked 2 and 3 and the ewe 3. Again for quick identification, single lambs may be marked in blue and twins in red. Ear notching can be used, but the same difficulties may occur as with the ewes; the open wounds left by this method could also let disease organisms in.

Marking with fluid calls for a set of metal numbers from 0 to 9, about 2 inches high, which are set at the end of a rod. Dip the number in the fluid, shake off the surplus paint, and press lightly but firmly on to the wool. Last year we marked the lamb on both flanks, but found that as it grew, and in wet weather, especially when on the roots which the Dorset Horns consume after Christmas, the numbers became distorted, and faded. This year we intend to mark on one flank at birth, and to re-mark on the other after about six weeks, or at such time as we feel it is necessary. Incidentally, if a lamb's number is in doubt it can often be proved by holding the animal back after re-marking, and seeing to which numbered mother it returns to suckle when let out.

Lambs kept back for breeding purposes can be tagged as soon as the ears are big enough, at about twelve weeks, or earlier if possible. The sooner a lamb is safely tagged the less risk of uncertain identification.

Weighing

Each lamb is weighed at birth. It can be placed in a sack which has string tied to the four corners, or in a bucket, and suspended from a spring balance. Some people use ordinary bathroom scales, standing on them with the lamb in their arms. If only one man is weighing, a light, portable tripod to hang the balance on is the answer. The next weighings take place when the lambs are twelve weeks old, although it is suggested that an intermediate weighing at six weeks could give a useful indication of the ewe's milking capacity.

This is comparable to National Pig Records, where the recommended weighings are at three weeks and at eight weeks, when the pigs are weaned. The easiest machine to use at these ages is in fact a pig weigher. When the flock is shorn, weights of fleece are recorded, and it would be possible, with the co-operation of a wool merchant, to get individual reports on the fleece of each ewe if they were numbered.

It may be argued that all these weighings entail a lot of extra work, but if a shepherd will accept the principle that it is all part of the flock routine, then except in a very large flock it is not arduous work. Furthermore, it adds concrete rather than merely verbal evidence to the flockmaster's skill.

Books required

A rough field book and a permanent flock record book are required for the keeping of the records. In the rough field book are entered the ear number of the ewe, her age, the sire, the date of birth of lambs, their sex, number, and weights at birth. The six- and twelve-week weights can also be entered. Any particular points of disease, such as incidence of foot rot, whether the ewe is a troublesome "backer", a difficult lamber, and the like, can be noted. If the lambs die, the reason for their death, if known, should be recorded.

Details from the field book are entered in the permanent flock record, which has a page for each ewe, recording her details as well as the details of her lambs. On that page can also be placed lamb disposals, prices received, and fleece details, as well as any relevant health history.

Does recording help?

It must be remembered that flock recording deals only with the ewes, and any improvement in the flock is limited to their genetic influence alone. However, it might eventually be of help to the ram breeders if it can be proved that the rate of liveweight gain in a growing ram can be transmitted to his eventual offspring kept under comparable conditions of management.

As far as the ewes are concerned, the selection of females that are consistently prolific and good mothers should improve over the years in any recorded flock. In practice, it could be argued that breeding stock should be kept only from ewes which have lambed twins consistently, if they have not been lambed for the first time as ewe lambs, when they often have singles. Two years' lambings should suffice to give a guide to the best ewes. A word of warning or controversy might be entertained at this stage—do we yet know just how far improvement in any flock is due to genetic influence, and how far it is actually due to better feeding and management? Even if genetic improvement is limited to, say, only twenty per cent, this should be no drawback to recording, since in recorded flocks management and feeding will tend to improve, because the recorder will instinctively wish it so, becoming more orderly in his methods.

As some indication of the sort of figures that recording gives, a summary of our averages may be of some interest.

FLOCK AVERAGES

	Singles		*Twins*		*Triplets*
	(15 male	14 female)	(33 male	33 female)	(2 sets female)
		Weight (*lb*)			
At birth	13·5	13·07	12·4	11·36	7·0
At 12 weeks	78·4	72·1	75·3	72·0	65·1

Fleece—5·73

PERCENTAGES

	Singles	*Twins*	*Triplets*
Two teeth	77·2	32·8	
Four teeth	24·0	72·0	4·0
Six teeth	35·3	58·8	5·9

If sheep recording can be agreed upon on a national scale, then we shall be able to compare our flocks with others kept under the same conditions of management, and have some yardstick by which to measure our efficiency as flockmasters. It will also tend to remove some of the "hidden mystery" with which sheep-keeping has always been bedevilled, and bring it more and more into a world of fact and understanding.

In conclusion I should like to pay tribute to our shepherd, because without his co-operation our flock could not be recorded.

The Year's Weather

L. P. SMITH, B.A.

Meteorological Office, Air Ministry

IF the summer of 1958 is best forgotten, the summer of 1959 was certainly one to remember. Taking the year as a whole, the round-by-round commentary ran like this:

JANUARY. Cold but with much sunshine; periods of wet weather and fog. There was snow over most of the country about the middle of the month, with a general thaw on the 17th and 18th. Frost and fog returned during the last week.

FEBRUARY. Winter continued until mid-month, but milder weather then set in, and the last day of the month broke maximum temperature records for February in many places, over 60°F being reached at places like Kew, Ross-on-Wye, Birmingham and Nottingham. The month was conspicuously dry, and farmers who were held up by the wet autumn were not slow to take advantage of this first favourable spell.

MARCH. The month was mild and dull, with reasonable amounts of rain. The absence of serious frosts hampered the preparation of tilths on heavy lands which lacked autumn cultivation; in these circumstances the preparation of good seedbeds was difficult, but otherwise the month was not unfavourable.

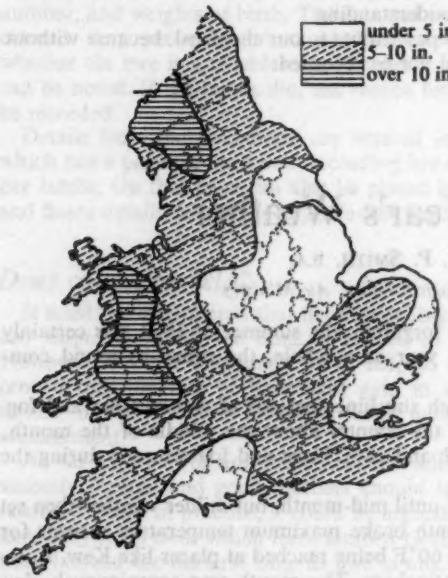
APRIL. A good month for growth, being warm and rather wet. It was markedly free from air frosts and there were no serious checks due to cold.

The year had still to show its true character, but had got away to a good start after a year like 1958, when everything seemed to hamper good farming.

MAY. This was, in fact, the key to the year; it was warm, dry and rather sunny, and it set the pattern which every subsequent month seemed determined to follow. There were touches of ground frost early in the month, but day temperatures over 80°F followed soon after, and the thunderstorms, although severe at times, never became a major factor.

JUNE. June continued the story, being warm and sunny and with only a few thunderstorms. Dry weather was clearly in the ascendant; grass was beginning to dry out in the east and south, and by the end of the month milk yields were dropping fast, but otherwise both the farming and meteorological barometers seemed to be "set fair".

JULY. There were times during July, notably about the 11th and again on the 25th, when the weather seemed about to break, but otherwise the recipe was much as before. Rainfall during these breaks was very sporadic and is reflected in the map below, which shows the result of the S.W.–N.E. track of storms across East Anglia. The grain harvest was earlier than usual and moisture contents were low.



Rainfall, May–September 1959.

AUGUST. The best guide to harvest weather is generally the character of the preceding months, for British weather is most persistent in type at this time of the year. This year was no exception, and although there were small amounts of rain during the first half of the month, they did not interfere with harvesting. It was only the south which reaped the benefit of this rain, for by now most pastures were looking very brown almost everywhere, especially in the east Midlands, where under three inches of rain had fallen in four months.

SEPTEMBER. An outstanding month for high day temperatures, plenty of sunshine and low rainfall. The drought was now becoming serious; water supplies in many areas were low. The ground was too hard to plough and most growth was at a standstill.

OCTOBER. Although western coasts experienced some relief, eastern and south-eastern districts remained dry for much of the month, and what had been a welcome guest had clearly now overstayed its welcome. Much farm work was, in fact, held up not because the weather was too bad, but because it was too fine.

This was indeed a queer state of affairs, and 1921 was the only parallel summer which remained in the memory of the old hands. This year, like 1921, was conspicuous for a summer which started in May and lasted until mid-autumn. The dryest five months on record in England and Wales is the period from February to June 1921, but 1959, with only 7·5 inches of rain, broke the all-time May to September record, previously held (for want of any better evidence) by 1750, with 8·1 inches. But 1959 was not the hottest summer even in living memory. June, July and August had a mean temperature of 62·4°F. Three times this century, in 1911, 1933 and 1947, we have had a warmer summer.

The mean figures of rainfall over England and Wales (Scotland was another story) were:

Month	1921	1959	*Long-term average* (1916–50)
	in.	*in.*	*in.*
January	4·3	4·1	3·7
February	0·4	0·4	2·7
March	1·9	2·6	2·3
April	1·3	3·2	2·4
May	1·9	1·1	2·6
June	0·4	1·8	2·2
July	1·2	2·8	3·2
August	3·9	1·5	3·3
September	1·5	0·3	3·1
October	2·1	3·4	3·7
November	2·7		3·8
December	3·1		3·5
Year	24·7		36·5

This table is eloquent enough by itself to show the extreme nature of 1959, but the map of May to September rainfall reinforces the lesson by showing the areas which have had the least rain. The driest areas lie between Derby and Doncaster, but parts of Essex and Suffolk were almost as dry. It was only the hills of Wales and the north-west which received over ten inches of rain.

Although the British farmer does not often meet a major climatic catastrophe, he has to face a variety of weather problems, and the weather of 1958 and 1959 gave a fair demonstration of the two extremes. If he can cope with both, he is no mean farmer, and has every reason to be proud of his capabilities.

Farm Rents Survey

In 1956 the Ministry of Agriculture, Fisheries and Food, together with representatives of landowners, farmers and the profession, promoted a nation-wide survey of farm rents in England and Wales. The word was undertaken by the Department of Estate Management, Cambridge University, and the results will be published in book form on 7th January 1960, by Messrs. George Allen and Unwin, under the title *Farm Rents: A Comparison of Current and Past Farm Rents in England and Wales*. The authors are D. R. Denman and V. F. Stewart, and the price 27*s.* 6*d.*

Farming Cameo: Series 2

20. West Gloucestershire

R. Guy Haines, N.D.A.
District Advisory Officer

West Gloucestershire is that wedge of land lying between the rivers Severn and Wye, bounded to the north by Herefordshire and Worcestershire. It is an area of variation and sudden change, history and beauty. The land ranges from Lias clay to blow-away sand, rising from the flood lands against the Severn to 900 feet in the Forest of Dean. The farming varies from cash cropping to part-time smallholdings, with only 36 per cent of the holdings more than twenty acres in extent. The farming types fall into two broad sections. North of the road running from Gloucester to Ross-on-Wye are the mixed arable farms with dairying; to the south are smaller, dairy holdings.

The mixed arable farms in the north extend up to 250 acres, and lie on heavier soils along the banks of the Severn and its tributary, the Leadon. Nowadays the size of the dairy herd is more often controlled by the labour force than by the buildings; milking parlours, in many cases, have replaced the traditional cowshed. This fertile land yields heavy crops. Output from winter wheat at £45 per acre is second only to the dairy herd, and is often preferred to grazing the land with store cattle, though flocks of Cluns and Kerrys are well established. Barley and winter oats are of secondary importance, but one-third of the farm is generally under crop to justify capital outlay in machinery.

On the red marl soils against the Herefordshire border, cash cropping gives excellent returns. Hops are no longer grown in this area, but still flourish on the more suitable soils of neighbouring counties. On this land two tons of winter wheat or twelve tons of maincrop potatoes per acre evokes no comment. In recent years peas and black currants have been introduced into the rotation. The peas go for canning, and the black currants are grown for processing to fruit juice. The humus content of the red marl can quickly be depleted by excessive cropping, leaving an intractable soil; because of this, the arable land rarely exceeds one-half of the total farm acreage.

These farms can reach a gross output of £70 per acre, but on dairy farms milk would contribute less than half of this. The output of a sale crop could be as high as £60 per acre. This makes an interesting comparison with another Gloucestershire arable area—the Cotswolds, where the sale crops average only £36 per acre. This, of course, is no guide to the profitability of farming in either district.

The farms south of the Gloucester/Ross-on-Wye road are in marked contrast. The small dairy farms between Gloucester and Chepstow, and those on the edge of the Forest of Dean, are similar to the 60–120-acre dairy farms in other parts of the country. The Friesian breed predominates; the plough is used only for kale and reseeding, and silage follows kale as a late winter bulk

food. The soil is a good medium loam, mainly over Red Sandstone, but Keuper marl and limestone subsoils exist in the area. While some farmers make £20 per acre profit on these holdings, many are below £13 an acre—the average profit for the Severn Vale. The most common limiting factors to high profit appear to be insufficient output for the size of the holding, too many followers in proportion to the dairy herd, feeding too much concentrates per unit of output (that is to say, over the average of 2·8–3 lb per gallon of total milk production), and uneconomic pig and poultry units absorbing the profits from other enterprises. Why must people keep pigs simply because they have pigsties?

Reference must, of course, also be made to the Forest of Dean, an area with its own peculiar problems. This royal forest covers some nineteen thousand acres on a saucer-shaped plateau in the south-western part of the area. The problems indirectly affecting the farms are the legal rights of free mining and the tradition of grazing sheep in the open forest.

The free mining is unique. On the edge of the Forest the coal measures are near the surface, often as little as two feet below the top soil. By ancient Royal Charter "anyone born and residing in the Hundred of St. Briavels" (approximately the Forest) who "has worked for a year and a day in a local mine" may become a free miner. This means he has a right to mine coal *anywhere* in the Forest where the "gale" or right has been granted to him, as long as he compensates the occupier of the land for any damage. This is drift mining, and workings are rarely more than 12–15 feet below the surface, with the result that subsidence becomes apparent soon after the mine is abandoned. Good, level fields become miniature mountains and valleys, and drainage systems are disrupted in the area—which has a rainfall of 40 inches. Reinstatement is expensive, and compensation rarely covers the cost.

Sheep grazing in the Forest is yet another difficulty. Apparently no legal rights can be established for the grazing of sheep, but they have become accepted on sufferance by the Crown. The lambs of the Welsh draft ewes and their crosses are mostly sold at the sheep sales held at Littledean and Coleford. No stints are allocated and there is no sheep register, with the result that it is very difficult to trace owners when sheep are found trespassing on farms, gardens and private property. The whole position has recently been considered by the Forest of Dean Committee, and their report* recommends that enclosures for the sheep be considered.

West Gloucestershire certainly provides a variety of everything, including scenery. From the highest points of the Forest the views over tops of mature trees and young plantations are impressive. To the east across the meandering Severn Estuary lies the Vale, with its heavy clays, bounded in the distance by the Cotswold escarpment. To the west are the Wye Valley and hills of Monmouth, with the Brecon Beacons beyond. To the north, in the foreground, are the fertile arable farms, with the Malvern Hills behind rising up to divide Herefordshire from Worcester.

To an Advisory Officer, it is a district with a warm-hearted, appreciative people, whether they farm the fertile red marl or the poorer land on the coal measures.

---

* A note on the findings of this Committee appeared in *Agriculture*, 1959, **66**, 207–8. The Report itself is obtainable from H.M. Stationery Office, price 8*s*. (8*s*. 5*d*. by post).

At the Farmers' Club

Agricultural Research—Closing the Gaps

"THE future historian of our industry will record that these last twenty years have seen an unexampled rate of progress," said SIR JAMES SCOTT-WATSON, C.B.E., M.C., at the Farmers' Club on 11th November. "Since 1939, the net farm output of the United Kingdom has increased by nearly 60 per cent, while the farm acreage has remained almost unchanged. Moreover, this great expansion has been achieved without any significant increase in our labour force, whose members are today toiling less arduously and for shorter hours than at any other time in our history."

He ascribed this remarkable acceleration in progress partly to the confidence in the future inspired by assured markets and guaranteed prices for our major products, which has encouraged investment. Then, too, the advisory services have been expanded and improved. "In particular the general practitioner—the district officer—has been given the support of a large team of specialists, and farm economists have equipped themselves to advise on the organization and running of many types of farming business."

But, said Sir James, the major factor has been the increasing rate of scientific discovery and invention. The number of research scholarships awarded by the Agricultural Research Council has increased from about six a year in the early 1940s to twenty or thirty during the past few years. Since 1939 six new research institutes have been created, including those for grassland, poultry and glasshouse crops. In addition, there are now more than a score of research units each covering a relatively narrow field, and universities and colleges receive grants for research in highly specialized subjects.

For the last twelve months our national bill for state-sponsored agricultural research exceeded £5 million, a sum comparable with expenditure in other "advanced" countries. Business concerns also make important contributions, for instance in farm mechanization. Most of the newer farm chemicals have originated in the research divisions of commercial firms.

To ensure the best use of the available manpower and research facilities, there is a Joint Committee of the A.R.C. and the Agricultural Improvement Council that lists the problems causing serious concern, and gives each one a priority rating. The help of progressive farmers and growers, advisory officers and research workers is obtained. Then, if the existing research effort to solve a particular problem seems inadequate, the A.R.C. considers how it can be stepped up, by re-deploying existing resources, or by recruiting new people and providing them with the tools for the job. As an example, Sir James cited the field bean crop, once important on heavy land as a major source of protein for feeding livestock. Today, however, supplies of high-protein concentrates in the form of oil-seed residues are abundant; hand-hoeing the crop is expensive; no satisfactory selective weed-killer has yet been found; and furthermore, the search for higher-yielding varieties, resistant to pests and diseases, has been unpromising. So there would seem to be more valuable ways of using available men and money than in breeding better beans.

Besides research aimed at solving specific problems in farm practice, there is "fundamental" research, which seeks a better understanding of basic questions, such as soil conditions and plant growth or the physiology of animal nutrition. For instance, by investigating how the very complicated process of ruminant digestion normally works, we shall be better able to understand the disorders that occur when it breaks down, and so learn how to avoid such troubles as bloat, ketonaemia and hypomagnesaemia.

Progress with different problems is made at greatly different rates. The role of the trace element molybdenum in promoting the growth of subterranean clover was discovered relatively quickly in Australia, aided by a fortunate chance observation. With potato blight, progress is slower. It has been necessary to go back to the wild species of *Solanum* for use in hybrid production, in search of genes that confer resistance to each of the many different races of blight fungus.

Hill farmers would give priority to bracken eradication among problems calling for intensified effort. The East Anglian farmer is concerned about wild oats and pigeons. On heavy and wet-lying land, farmers anxiously await mechanization and cheapening of field drainage. Beef cattle and sheep breeders wonder whether present showyard standards are still appropriate, now that consumers demand smaller joints with less fat.

Modern pasture plants and heavier fertilizer usage have led to greatly increased rates of stocking and an extended grazing season, with correspondingly greater risks of parasitic worm infestation. At Hurley, this problem is being tackled by a modern version of "running the lambs forward" and by building up worm-free flocks and pastures. The idea of using irradiated cultures of the husk worm for inoculating calves against husk, developed at Glasgow, may be applicable in principle to control other worm parasites.*

Against wood-pigeons, shooting is an unproductive occupation and nest destruction seems to be the only promising approach. The Infestation Control Division of the Ministry of Agriculture have recently published an interesting paper on this subject.†

Bracken can be controlled by chemicals, but the cost so far is prohibitive. Though repeated crushing with what an Irishman called a "square roller" works well, it cannot be used on boulder-strewn land. Hay made from mown bracken, steamed to destroy the poisonous principle, will support ewe lambs on the hills during their first winter—but mowing is often impracticable.

"My conclusion," said Sir James, "must be that the gaps in our knowledge are still many and wide, but that resolute efforts are being made to fill them."

Sylvia Laverton

---

* Husk—The Development of a Vaccine. N. C. C. Sharp. *Agriculture*, 1959, **66**, 241–5.

† Attacking Wood-pigeons in their Nests. R. K. Murton. *Agriculture*, 1959, **66**, 199–201.

THE MINISTRY'S PUBLICATIONS

Since the list published in the November 1959 number of AGRICULTURE (p. 356) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops or through any bookseller at the prices quoted.

BULLETIN

Technical Bulletin No. 2. Laboratory Methods of Work with Plant and Soil Nematodes (*Reprinted at new price*) 4*s.* 6*d.* (4*s.* 11*d.* by post)

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 6d. (8d. by post).

ADVISORY LEAFLET

No. 392. Lettuce Aphids (*Revised*)

FIXED EQUIPMENT OF THE FARM LEAFLET

No. 41. Deep Litter Hen House (*New*) 1*s.* 3*d.* (1*s.* 5*d.* by post)

One free copy of Farm Machinery Leaflets may be obtained on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 6d. (8d. by post).

FARM MACHINERY LEAFLETS

No. 2. Binders (*Revised*)

No. 6. Plough Setting (*Revised*)

FREE ISSUES

Obtainable only from the Ministry (Publications), Soho Square, London, W.1.

UNNUMBERED LEAFLETS

Full-time Agricultural Education in England and Wales (*Revised*)

Suggested Seeds Mixtures for Welsh Grassland (*Revised*)

In Brief

1960 GAME FAIR

The Country Landowners' Association's Game Fair, which has now established itself as one of the most popular events in the farming calendar, will be held in 1960 on July 14–15th at Castle Howard, in the West Riding of Yorkshire. This follows immediately after the Great Yorkshire Show. The owner of the Castle Howard estate is Mr. George Howard, who will be the chairman of the organizing committee. Attractions for coarse as well as fly fishermen are being introduced at this event.

SUPPLEMENTS TO SILAGE

Dr. J. C. Murdoch, of the National Institute for Research in Dairying, spoke about supplementary feeding to silage at this year's annual conference of the Institute of Corn and Agricultural Merchants. In theory, he said, it should be possible to produce grass silage of a quality comparable to that of grazing, but in practice, because of the high moisture and low carbohydrate content of young, leafy grass, it is difficult to obtain satisfactory fermentation. Silage, therefore, is usually inferior in feeding value to grass and, in addition, the animals are unlikely to eat as much silage, even when well-made, as they would of grass. So while a high-yielding cow can give her full milking potential on young, leafy grass, it is unlikely that she will do so if fed on silage only.

In particular, said Dr. Murdoch, it is on the smaller farm that the value of supplementary feeding should be considered. Circumstances will differ of course from farm to farm and therefore he could only generalize. "When only medium yields are aimed at (about 5 gallons per cow, per day) it is quite feasible," he said, "to rely entirely on silage and cereals, provided the protein in the silage is adequate for this production. This has been done experimentally and commercially with considerable success. The protein content of the silage is an obvious limiting factor, but with *ad lib.* feeding and a well-made silage with a crude protein content of about 14 per cent, cereal supplementation will be adequate. There is, however, one practical difficulty, and that is that in milking parlours there may be insufficient time for the cows to eat the required amount of cereals. The time required for a cow to eat bruised cereals appears to be about one-third longer than for cubes and, particularly in the case of the one stall/one unit parlour, the available time may be too short for the higher yielders to eat sufficient cereals. There is, therefore, a need for a cube composed almost or entirely of cereals to deal with this situation, provided, of course, that the price is attractive.

"The other system of supplementation, where high milk yields are expected, is a combination of cereal and dairy cake, the cereal being used to balance the silage to a production level of 3–4 gallons and then supplementing with dairy cake. Unfortunately, this involves a bit of thought and extra work, but as a system it will pay dividends in reducing the cost of the concentrate ration. Many farmers, however, ignore this advantage because of the convenience of feeding a standard cube and it must be admitted that, with carefully controlled feeding of the dairy cake, they still make a good profit, although perhaps not as high as it might be."

R.A.S.E. RESEARCH MEDAL

The Royal Agricultural Society of England offers annually a medal, together with an award of one hundred guineas, for research work of outstanding merit carried out in the United Kingdom which has proved, or is likely to prove, of benefit to agriculture.

Recommendations for this award can be made by the heads of university departments, research stations and institutes and other research organizations. No direct application by candidates will be considered.

Recommendations for the next award must be submitted to the Secretary, Royal Agricultural Society of England, 35 Belgrave Square, London, S.W.1, not later than 30th January, 1960, and be accompanied by nine copies of a brief statement of the candidate's attainments and a list of his publications.

LIGHTING THE FARM

Planning is the key to full use of electric lighting. It will ensure that there is enough light for every purpose, good use of every lamp, flexibility of switching to avoid waste, and co-ordination of the whole scheme with the working arrangements of the farm and with natural lighting.

Farm buildings range from the traditional type to the modern structure, and the natural indoor lighting varies accordingly. Account must be taken, at an early stage in planning, of the limitations imposed by the building: for example, inadequate window light may lead to long use of artificial lighting, and so justify the capital cost of fluorescent lighting. In modern farmsteads, electric lighting is usually built in, and can be integrated properly with the natural lighting.

Whatever the layout, the lighting requirements are closely related to the farm routine, and it is this which most affects the choice of equipment. Tables are available which show the recommended illumination for various tasks, and for many types of interior. When planning the installation, your electrical engineers or contractors will take into account the suitability of the light as regards glare, shadows and direction, as well as the illumination required. In general, diffusing lamps will be used in sufficient number to avoid deep shadows and light the working areas.

It is important to obtain competent advice in choosing your equipment: a wide range of fittings is available, to cover all conditions of service in and around the farm buildings. For instance there are vapour-proof fittings for fluorescent or filament lighting in cow houses.

The farmer should consider both present and possible future requirements, and then discuss them with his electrical engineer or contractor, before actually planning the installation. This, and the work of installing the wiring and equipment, should be carried out only by those competent to do it. And remember: proper care and maintenance of the installation will ensure that you always have light.

R. A. Bayetto,
British Electrical Development Association.

AGRICULTURAL RESEARCH COUNCIL: NEW SECRETARY

Professor E. G. Cox, T.D., D.Sc., F.Inst.P., F.R.I.C., F.R.S., Professor of Inorganic and Structural Chemistry in the University of Leeds, is to succeed Sir William Slater, K.B.E., D.Sc., F.R.I.C., F.R.S., as Secretary of the Agricultural Research Council on Sir William's retirement next year. Professor Cox's appointment will take effect from 1st July 1960.

Book Reviews

Rural England, 1086–1135. REGINALD LENNARD. Oxford University Press. 45*s*.

With this detailed account of rural life, Mr. Lennard has provided a most welcome addition to existing works on Domesday England. He devotes his attention entirely to social and economic conditions in the countryside, and is not concerned with the legal aspects of Anglo-Norman society which have received so much attention in the past. As a result, when he is not treading new paths, he is covering known ground with a new and revealing thoroughness. The Domesday Book naturally provides the starting point for this survey, but much evidence from the next fifty years has been assembled, and few rural topics are passed by.

The book begins with a picture of England before the Norman Conquest, emphasizing the great extent of arable land that existed side by side with extensive woodland and waste. England, indeed, was "an old and settled country" when William the Conqueror arrived on the scene. In the following chapters the author deals with life under the impact of Norman feudalism; the great landlords—most of them foreigners—and their large, scattered estates; methods of estate management and manorial organization; the economy of village communities, and its variation from place to place; with village churches and their clergy, and with the land holdings and feudal obligations of the peasantry. Wisely, the author does not attempt to discuss agricultural technique: little information is available for his chosen period, and he is meticulously careful not to illustrate twelfth-century life with later medieval evidence.

Of special interest is the analysis of some of the large estates of the great Norman overlords. Such estates often included land in several counties, and methods of management necessarily varied from manor to manor. The considerations which led landlords to work some of their manors directly and personally, while subletting many others to tenants are discussed. It was, of course, the sub-tenant—the immediate landlord—who was instrumental in shaping agricultural policy and the working conditions of the peasantry: accordingly, much attention is given to the conditions of the leases made to sub-tenants. Leases for money rents were apparently far more common than has often been supposed, and were often "stock-and-land leases", under which the landlord provided much of the stock.

Mr. Lennard tells us that he has spent "a good many years" in his researches; those interested in agrarian history will study his book for a good many more.

K.J.A.

Bumblebees (New Naturalist Series). J. B. FREE and C. G. BUTLER. Collins. 25*s*.

This book will be welcome as a useful study of the behaviour and social life of bumblebees. The text, which is mostly based on scientifically published observations, carries a natural emphasis on the recent work of Brian, Cumber and Free, but earlier observations have not been disregarded. References are given in an extensive bibliography, and there is a good index. In appendices by Dr. Ian Yarrow there are keys to the identification of British bumblebees, and an account of the distribution of the British species.

But the book is not a review of the subject in the scientific sense. The quoted examples are not necessarily the earliest or the only examples of the behaviour described. The emphasis is on description, not on critical analysis—an attitude which perhaps makes the book more palatable than it otherwise would be to the general reader, for whom the New Naturalist series is produced.

The authors' views are given in full, but they are not always contrasted with views held by others. For instance, the experiments of Free (1955) are quoted in the chapter on division of labour, and a reference is given to the work of Brian (1952), but the fact that Brian obtained opposite results and drew contrary conclusions is not mentioned.

Bumblebees returning with pollen loads were seen to take longer trips than those which returned with nectar only; it is not

pointed out that this is a surprising contrast to honeybee behaviour, which happens because all bumblebee pollen collectors collect nectar as well, and the nectar-only collectors are the smallest foragers.

Personally, I found the chapters on recognition of friends and foes, and on the *Psithyrus* bumblebees which act as cuckoos in *Bombus* nests, to be of special interest. In the absence of the honeybees' mechanism for sharing food between adults, no common colony odour is produced internally by bumblebees; the scent of a common nest odour provides a less efficient defence, because it can be more readily picked up by an intruder. Hostility between bumblebees is predominantly sexual, between bees with developed ovaries. No complicated mechanisms of communication between individuals are known.

The chapter on the economic importance of bumblebees will be of special interest to farmers, and the value of bumblebees for red clover pollination is rightly emphasized. Unfortunately, there is no known method by which bumblebee numbers may be economically increased, but farmers who grow red clover crops for seed may note that fields in the vicinity of woods or waste ground are more likely to be close to bumblebee nests than exposed fields, and that a small field is likely to attract more bumblebees per acre than a large one.

Dr. Colin Butler has decorated the book with twenty-four pages of attractive black and white photographs, and as a frontispiece there is a colour plate of some of our common bumblebees, which will be of help to those starting to study them.

C.R.R.

Agricultural Holdings (11th Edition). J. MUIR WATT. Sweet and Maxwell. 55*s*.

Jackson's *Agricultural Holdings* has been a standard text-book on agricultural tenancies and tenant-right for nearly fifty years. Mr. Muir Watt is third in a line of brilliant authors who from time to time have brought the text up to date. Like the original and subsequent editions, this revision has two principal sections: one is a general statement of the legal principles governing the relationship of landlord and tenant of an agricultural holding; the other is a manual of tenant-right valuation. Except for this basic similarity, the latest edition has been rearranged, and greatly improved. To write the section on tenant-right valuation Mr. Muir Watt called to his side Mr. Derek H. Chapman, whose well-known writings on agricultural affairs cast a spell of their own over all who read them. Two further sections (Parts III and IV) provide fully annotated texts of the Agricultural Holdings Act, 1948, the Agriculture Act, 1958, and the relevant Statutory Instruments.

In arrangement, the text of the first section is admirable. Mr. Muir Watt's thought is clear, logical, technically correct, yet devoid of all pomposity. He is scholarly at all points, giving generous foot-note guides to his sources. His positive achievement is faultless; what he does, he does exceedingly well. Fault is too strong a word for omissions which will be noticed only by readers who think his fear of being academically speculative denies them full access to the treasure house of his ample mind.

While Muir Watt is the precise draughtsman, Chapman is the irrepressible artist—colourful, creative, unorthodox, but very far from unbecoming. To read him is a delight. In more than one place, however, his Chelsea inspiration blurs the image he wishes to depict, and will confuse the serious student whose mind has been disciplined by the rigour and logic of Muir Watt's pages.

Mr. Chapman keeps to the surface of things—there are questions he leaves unanswered; and many more left unasked. A possible explanation of this seeming lack of profundity is his masterly ability to portray the valuer to the valuer. Ideally, in Chapman's phrase, the valuer is one who practises what law and custom preach. Portrayed in the process of tenant-right valuation, however, the valuer is rather careless of what the law requires and expects. In the first section of the book, for example, Muir Watt sets out four different measures of compensation which at law govern the landlord's claim for dilapidations: cost of making good, damage to the reversion, damage to the holding as a holding (Section 58) and damage actually suffered by the landlord. Mr. Chapman, doubtless following faithfully the valuer's thought and practice, makes no attempt to draw the distinction required between these different methods.

Between the two main sections of this book runs the great gulf which divides the lawyer's world with its rule of law, from the valuer's world with its rule of thumb.

D.R.D.

Asparagus. A. W. KIDNER. Faber and Faber. 25*s*.

Horticulturists can now have an up-to-date edition of A. W. Kidner's research and experiences with asparagus. Few growers have time or incentive to pursue the subject in the detail indicated by the author, and yet reading his book carefully one discerns he is not once diverted from his goal—indeed any challenge is soon under heavy fire from his knowledge and experience.

He traces asparagus from Roman and Greek culture—although the actual word was derived from Persian, and Persian from Sanskrit. I am relieved to know that he recognizes the uniform level of the species. Growers have been able to maintain the vegetable under its own laws of heredity for more than 2,500 years, sometimes producing outstanding quality of yield, only to be surpassed by Mr. Kidner in breeding for weight of sticks (¼ lb) and yield per acre. Is it possible, however, to become vulgar in cultivating enormous single heads, which would embarrass one at dinner?

His experience in genetics of horse and cattle has been applied to this vegetable, and his skilful practical reasoning breaks new ground as regards asparagus. He denies variety of asparagus, on the grounds that "bi-sexual species are not hermaphroditic and will not breed true", yet admits that many varieties are grown. There can be little doubt that at least three distinct shapes of stick and head call for some classification. He calls them types.

Rhizome is also a misnomer, as he readily admits. Surely the true rhizome is the seat of the crown, a fleshy, woody fibre which sends its roots downwards and buds upwards—conserving in itself food for extension as the buds are cut in due course.

The author's commendable zeal in putting all his knowledge into practice is an encouragement to would-be growers. His reclamation of land in 1932, increasing the high productivity and quality of his asparagus, demands and deserves patient study. The choice of soil seems not to worry him, though he prefers lighter soils, of course, as conducive to the travelling habit of the plant. Considering that asparagus was grown, to our knowledge, from India through Asia, Europe and in California, the main essentials appear to be a high water-table, good drainage, phosphates, lime and potash with humus, nitrogen being added as necessary.

One scarcely knows what part of the book to commend above another. It must be recognized as a record of many years of work on this one vegetable, by one man, now nearly 80 years of age; the frequent allusions to himself are unavoidable in these pages. A masterful book for experienced growers, and for amateurs, it is written with sudden shafts of reminiscence culled from his rich experience—the Bible, the classics and history, down to the common parlance of the countryside—which will commend it widely. It is strongly recommended by an asparagus grower for half a century.

There remains the critical question to ask. Has Mr. Kidner a disciple understanding his teaching, to continue this breeding and selection, which he insists must be maintained, or shall we have to revert to six-ounce sticks of asparagus?

A.W.S.

The Farmers Weekly New Question and Answer Book. Compiled and edited by H. C. FREETH. Hulton Press, Hulton House, 161–166 Fleet Street, London, E.C.4. 6*s*.

This is a second collection from the many questions received every week by the *Farmers Weekly*, together with the answers given by the advisory staff of that paper. The book, of 370 pages, is full of information on a variety of subjects, covering in general terms buildings, arable crops, grass, machinery and, by far the biggest section, cattle, pigs, poultry and sheep. It is very interesting to study the kind of questions which are put. The majority of them concern livestock, truly reflecting the important part which animal husbandry plays in British agriculture. A further analysis shows that most of the livestock questions are on veterinary matters.

This is not a book for solid reading, but rather one in which to browse for reference. Farmer and student alike should find it immensely useful, and agricultural advisers may well discover in it pointers to the kind of information that seems to be wanted. At this time of the year (and I am sure the publishers were not unmindful of this) it would make an excellent, inexpensive Christmas present.

R.E.

Scientific Principles of Feeding Farm Live Stock. (Proceedings of a Conference held at Brighton, 1958.) Farmer and Stock-Breeder. 50*s*.

So much work has been carried out, and published, in recent years on the feeding of farm livestock that it is practically impossible for any one person to be familiar with all the literature on the subject. The proceedings of this conference will, therefore, be warmly welcomed by teachers, research workers, advisory officers, commercial interests and stockmen. Each section has been written by a specialist, and each chapter contains an excellent reference list for those who wish to pursue the subject more deeply.

It is desirable to review the validity of feeding standards periodically, as they may have been derived from the results obtained with less productive animals, and were designed to meet consumer needs which no longer apply. The information given in this publication will be invaluable in directing the trends of modern research into channels likely to be most beneficial to the livestock industry.

The literature on the feeding of dairy cows has been ably reviewed by Dr. Blaxter from the standpoint of what information is needed by farmers and their advisers. Those who considered that the feeding standards for dairy cows were firmly established, and had withstood the test of time, will receive a rude awakening on reading this chapter. Evidently we have been underfeeding our dairy herds or, to be more exact, we have overfed the low yielders and underfed the high yielders. Therefore, what is more logical than the proposal to introduce a graduated system —the present energy standards being increased for cows with a high peak yield, and correspondingly reduced for low yielders—or is this making matters unnecessarily complicated? Dr. Baxter rightly emphasizes the paramount importance of producing high quality coarse fodder for the dairy herd, the object being to maintain appetite, rather than to ensure adequate consumption of nutrients.

Voluntary feed intake has been found to vary, in the same individual, between 18 and 40 lb dry matter a day. The amount consumed is inversely proportional to the indigestible matter fed. However, in view of present developments, it is disturbing to read that rations based on silage and kale are associated with poor quality milk. This must be looked into further.

We also turn eagerly to the chapter on the feeding of pigs to discover the present position regarding recent developments, such as the feeding of antibiotics or the artificial rearing of baby pigs. Have these concepts come to stay, or are they just a passing fancy? Unfortunately, lack of space prevents discussion of these and other topics of absorbing interest which were considered at this conference.

This is the first comprehensive conference on the feeding of livestock in this country for some years. It is pleasing to find a new generation of animal nutritionists coming along, and what better springboard for the next advance can they find than the wealth of information presented in this volume? It gives a sure foundation to build on. Perhaps they will not be so ready to conclude that the starch equivalent system has outlived its usefulness?

After reading this book, one cannot help feeling that one of the greatest gaps, at present, is our lack of precise knowledge of the scientific principles of feeding ruminants on pasture. We want to know a good deal more about the supplemental feeling of the grazing animal.

R.E.E.

The Iris (Revised edition 1959). N. Leslie Cave. Faber and Faber. 36*s*.

An encouraging happening in this era of small gardens is that many horticulturists are specializing in the cultivation of one type of flower. Thus the fund of horticultural knowledge and skill is maintained, or indeed extended, even after the passing of so many great gardens.

There are now a number of books covering specialist gardening, and this one, devoted to the iris, is one of the most successful. The author sets out to provide not only a reference book for the experienced iris grower, but also an introduction to those not yet completely under the spell of one of the most fascinating of flowers.

The field is wide, but the author is at pains to cover it and include new developments, which have come thick and fast since the first edition was written, twenty years ago.

Six chapters are devoted to iris species, 234 of which are tabulated in an appendix for reference, indicating their range of form, colour and flowering periods, together with their special cultural needs. Well-known and recently introduced forms, especially among the *Sibiricas*, are all included.

Pride of place, as by right, is given to the bearded iris, and the author gives unstintingly of his great knowledge. Enormous developments have taken place within the last thirty years; new chapters are devoted, for instance, to the new dwarf and intermediate irises, introduced within the last ten years, and to the work of hybridizers in the U.S.A. and Canada.

Hybridization and the selection of seedlings are perhaps the subjects dealt with outstandingly well; the book provides every detail that the creator and would-be creator of new varieties will need. An excellent and clear exposition of the rules of inheritance is offered almost apologetically. If criticism must be made, it is that the author is too fearful of his readers being science-shy; I hope that reassurance on this point will encourage him to develop the chapter on pests and diseases along more scientific lines in future editions.

There are generous illustrations, in both colour and monochrome, the latter being particularly good, and the general format is extremely pleasant. The author is to be congratulated on a rare achievement, that of producing a book which is not only a fund of information for the specialist but is also very readable, illuminating and stimulating to the complete novice.

K.H.J.

Silage and Haymaking. IAN MOORE. Farmer and Stock-Breeder. 9*s.* 6*d.*

In this manual Professor Moore summarizes the present-day position of conservation. The book opens with a general consideration of the different processes in the production of winter food. While underlining the widespread popularity of haymaking, the author emphasizes the advantage of making silage, which can be of the highest value because the crop can be cut at its leafiest and most nutritious stage of growth.

The different ensilage processes are dealt with, and their practical importance is compared. In general the well-established methods are to be desired, though the modern operations of wilting, chopping and laceration are helpful.

After discussing the wide range of crops that can be ensiled, the author turns to the type of silo. Here he tends towards simplicity, especially since self-feeding is now becoming so general. At Seale-Hayne this labour-saving method is obviously a well-integrated part of the farm practice. Modern mechanization has helped the maker of silage, and the trend towards such machines as forage harvesters is described.

The next part of the book, which is an addition to Professor Moore's earlier and well-known *Silos and Silage*, deals with other methods of conservation; that is, those dependent on natural or artificial drying. The process of haymaking is dealt with briefly, and the possibility of barn drying is considered, though it is clear that further information is still needed on this subject. The use of special appliances such as hay-racks is not forgotten, but their limitations are noted. Artificial grass-drying, whilst it is technically the most efficient process of conservation, calls for a very heavy capital outlay and little more is said about it.

Much valuable information about the feeding value and practical use of the grassland products, and their cost of production, is contained in the last two chapters, which round off a very readable and practical book.

S.J.W.

Rothamsted Experimental Station Report, 1958. 10*s.*

During his eighteen-year directorship, which ended when he retired last September, Sir William Ogg increased the staff of the Rothamsted Experimental Station from 140 to 471. He also created three new departments—biochemistry, nematology and pedology—thereby extending still further the scope of our oldest agricultural research centre.

The latest annual report from Rothamsted records the development of improved methods of extracting and preparing leaf protein for human consumption. Encouraging yields have been obtained: 471 lb of protein an acre from spring oats cut in June, and 546 lb an acre from nettles, growing wild apart from a small dose of fertilizer. Thus, through this process, a use may be found for plants that now contribute nothing to human nourishment.

New information about the factors affecting the movement of eelworms through soil and on plants is reported. Considerable progress has been made in isolating the substance, as yet unidentified, exuded by potato roots, which induces cysts of the root eelworm to hatch. Most of the long-term field trials to control

virus spread in potatoes by spraying insecticides ended in 1958, after showing that this method can keep seed stock from deteriorating for up to five years. Preliminary tests have shown that systemic insecticides applied to beet seed and potato tubers, or to soil at planting time, can give protection from aphid-borne viruses for relatively long periods.

At Rothamsted, the ley arable experiment and the rotations testing the effects of ploughed-in straw suggest that organic matter affects crop growth solely by contributing nutrients. In some light soils, however, organic matter seems necessary to maintain structure. Sugar beet failure (Docking disorder) that occurs on certain almost structureless, light, alkaline soils is controllable by leys or organic manures.

The report includes an illuminating account of the Woburn Experimental Station's work since its foundation in 1876, and a detailed summary of 1958's work with sugar beet at the Dunholme Field Station.

S.L.

The Shell Guide to Wild Life. GEOFFREY GRIGSON and JOHN LEIGH-PEMBERTON. Phoenix. 7*s.* 6*d.*

There is little doubt that this the fifth (and last) of the Shell Guides to natural history subjects will evoke the same enthusiastic admiration as has been accorded to the others. Geoffrey Grigson's text and John Leigh-Pemberton's colourful and painstaking paintings combine to make an enticing introduction to the fascinating study of animal and plant ecology in any of the dozen localities which the book's compilers have selected. Each is shown to have its own special life associations.

So, for example, "Life by the Stream" is seen to include the moorhen, kingfisher, water-shrew and rat and, among plant life, the yellow-flag, purple loosestrife and soft rushes which for long furnished the basic material for cottage rush-lights. Wild orchids, thyme and horseshoe vetch are part of the downland scene, with the Chalkland Blue and Adonis Blue butterflies, the lapwing and the migrant wheatear.

Insectivorous plants like the round-leaved sundew and butterwort are shown with heather and the bog asphodel on moorland, and similarly our cliffs and beaches, meadowland, roadside verges, walls and trees equally display an interesting partnership of plant and animal life for those who are able to look with "the seeing eye".

The other four books in this series, all priced at 7*s.* 6*d.*, are: *Flowers of the Countryside, Birds and Beasts, Fossils, Insects and Reptiles,* and *Trees and Shrubs.* Looking at them, I cannot escape the feeling that many people would welcome their being brought together into an omnibus publication while the plates and texts are still available.

S.R.O'H.

Piers the Ploughman. WILLIAM LANGLAND. (A new translation by J. F. GOODRIDGE.) Penguin Books. 3*s.* 6*d.*

William Langland's poem has proved of enduring interest to the student of literature and language, to the medieval historian, and to the general reader enthralled by its satire and morals. It is to the general reader that this new translation is addressed.

Mr. Goodridge's aim has been to render the full sense of the poem in intelligible modern English, and in so doing has preferred prose to the alliterative verse used by most previous translators. Langland himself, of course, wrote in alliterative verse, and much pleasure is to be derived from translations which seek to preserve something of the style and the sound of his lines. But Mr. Goodridge argues that we cannot have the sound as well as the sense, and he believes that Langland's thought and ideas are all-important. A comparison between the new translation and the excellent alliterative version in the *Everyman Library* brings out the force of his argument. Remembering the many difficulties of the original verse, the general reader will certainly appreciate the service which Mr. Goodridge has performed; the detailed interpretation which accompanies the translation will be equally appreciated.

Piers the Ploughman has been described as a Christian poem about humanity, dealing with the most important of all questions to the Christian—how can a man win salvation? The poem takes the form of a series of dreams in which the dreamer seeks the answer to that question. In his personal search for the truth, and in attempting to bring home its morals to his contemporaries, Langland, like many medieval writers, made wide use of allegory; creating innumerable characters, each embodying many of the good and

evil characteristics of his society. It is from these figures—Sloth, Reason, Waster, Dr. Civil Law, Lady Lucre, Guile and the rest—that so much can be learnt of the life of the fourteenth century. The historian is especially rewarded by Langland's descriptive passages, like that of the familiar "fair field full of folk", and the reader of an agricultural periodical will glean instructive details from the dreamer's vision of Piers, the ploughman.

K.J.A.

Agricultural Policies in Western Europe. (Occasional Paper No. 3.) Political and Economic Planning. 3*s.* 6*d.*

The concise title of this pamphlet gives an unduly expansive impression of its contents. Agricultural policies here refer to price support policies; it is the conflict of interests resulting therefrom, and the attempts made to reconcile them, that are examined.

In the post-war years, a common objective of the thirteen countries concerned was to increase agricultural production. This has now given way to the main aim of maintaining the incomes of those working in agriculture. The change is due to the problems created by high production in response to prices supported at levels above those in the free market. Such increased output also adversely affects the trade of other nations, and consequently strains international relations.

The examples given of conflicts between national policies draw attention to the fundamental question: how to support the prices the farmer receives. The choice between tariffs and quotas or deficiency payments and buffer stock schemes largely determines the effects on international trade. It decides the extent to which free market forces influence the producer, and whether the cost of a price support policy should be apparent in public payments or hidden in higher prices paid by the consumer.

More "confrontation", which involves the discussion of a policy with the other countries affected by it, is suggested as the most hopeful way of adjusting agricultural policies to avoid damaging the interests of other nations. Confrontation produces an awareness of the nature and implications of a policy that is hard to ignore, however much anyone might like to. It resorts to the power of reason, working through the desire to be seen to be acting reasonably. Coming after an account of the difficulties of various meetings and "plans", this is a pleasantly human conclusion.

A.V.V.

Enterprise and Responsibility: I.C.I. in Agriculture. Imperial Chemical Industries.

For over thirty years I.C.I. have been vitally concerned with the prospects of British farming, for their aim has always been to provide as much fertilizer, particularly nitrogenous fertilizer, as the circumstances of the time demand. Moreover, their policy has been to increase demand by an enlightened research and educational programme which has been a valuable supplement to similar work done by official bodies. The small booklet under review gives an excellent account of the company's agricultural activities since the early 1920s, and in so doing brings out and presents in an interesting way much recent fertilizer history which would be difficult to collect from other sources.

The story starts after the first world war, when the Billingham site for a nitrogen fixation plant was taken over from the Government. From 1924 onwards, Billingham began to make an increasing amount of sulphate of ammonia, though at first the synthetic material was small in relation to the by-product from gas works and coke ovens. At this time total production was far in excess of home demand and a substantial surplus was exported. To increase home consumption, the use of "straight" nitrogen top dressings was further publicized, and compounders were induced to raise the percentage of nitrogen in their mixtures. This was a wise change, which has now gone so far that present-day mixtures contain three times as much N per ton as those of thirty years ago. "Nitro-Chalk" was introduced in 1927 to provide farms with an alternative to imported nitrate of soda, and by 1958 the home sales had reached 440,000 tons.

In 1931, the well-known concentrated complete fertilizers based on monammonium phosphate were put on the market in granular form. On the outbreak of the second world war, the use of nitrogen to increase food production was taken up as a leading item in agricultural policy, and the consumption more than doubled. That this progress has been maintained is due in part to the Government subsidy, which has kept the farmers'

Jack BARCLAY
LIMITED

The Largest Official Retailers for
ROLLS-ROYCE and BENTLEY
★
BERKELEY SQUARE, LONDON, W.1
Mayfair 7444

TAKE ADVANTAGE OF THE FERTILISER SUBSIDY

★Literature and advice free from J. Harold Thompson, B.Sc. (Agric.), Chief Agriculture Adviser BRITISH BASIC SLAG LTD., Wellington House, Buckingham Gate, S.W.1. ABBey 4606-7-8 or in Scotland from J. S. Symington, B.Sc. (Agric.), 116, Morningside Drive, Edinburgh, 10. Tel.: 51791.

THERE IS NO SUBSTITUTE
for
BORDEAUX MIXTURE
BY TEST STILL THE BEST

There are two ways of protecting plants against fungus diseases. One way is expensive—the other, the Bordeaux Mixture way—is economical.

Freshly prepared Bordeaux Mixture has this triple advantage over other fungicides.

- Per unit of copper—the active ingredient—Bordeaux Mixture is cheaper.
- Because of its superior sticking properties Bordeaux Mixture is retained on the plant longer.
- Bordeaux Mixture leaves a more visible deposit, thus enabling the operator to see if the spraying has been properly done.

Why not rediscover the merits of Bordeaux Mixture by using only the best quality Copper Sulphate 98/100% purity, supplied by

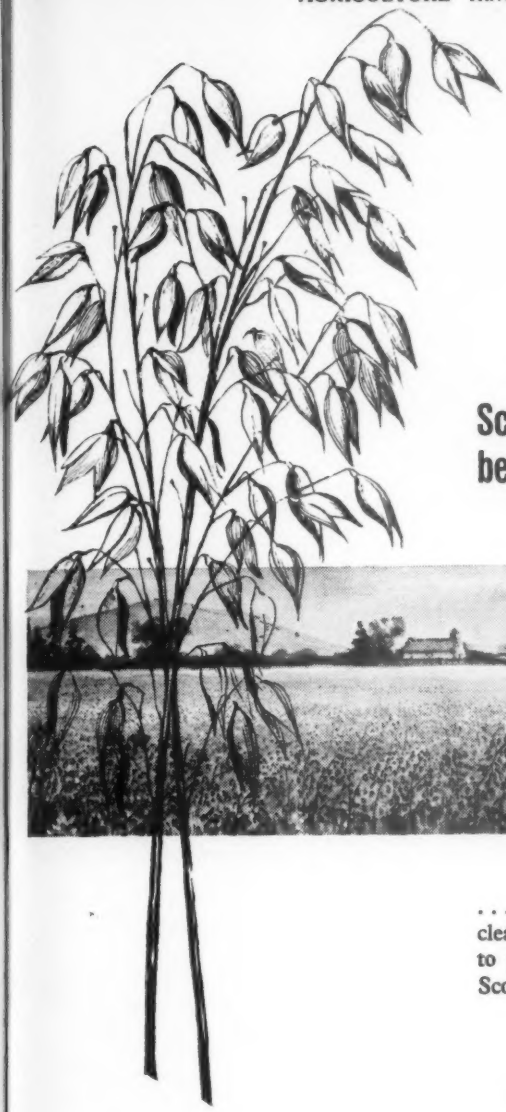
BRITISH SULPHATE OF COPPER ASSOCIATION LTD.
1, GREAT CUMBERLAND PLACE, LONDON, W.1.
Telephone: PADdington 5068

Your advertisement in AGRICULTURE
will be
READ AND REMEMBERED
by the
IMPORTANT PEOPLE
IN THE INDUSTRY

Enquiries and instructions relating to advertisement space in the 1960 editions should be addressed to:

COWLISHAW & LAWRENCE (Advertising) LTD.
14-16 LUDGATE HILL
LONDON, E.C.4.
CITy 3718 (3 lines)

Space is limited.
Make your reservation early.



Scotland grows the best oats in the world . . .

. . . and the pick of them are granary cleaned and carefully graded by S.A.I. to provide you with the finest quality Scotch Seed Oats

S.A.I. SEED OATS

the pick of the Scotch crop

SCOTTISH AGRICULTURAL INDUSTRIES LIMITED

From your usual merchant; for the name of your nearest supplier, write to Scottish Agricultural Industries Ltd., Central Office, 39 Palmerston Place, Edinburgh 12

now that's worth ..... knowing!

What is?

Why, the new Lucas "Seal of Security" of course. It's on every Genuine "BRP" Replacement Unit.

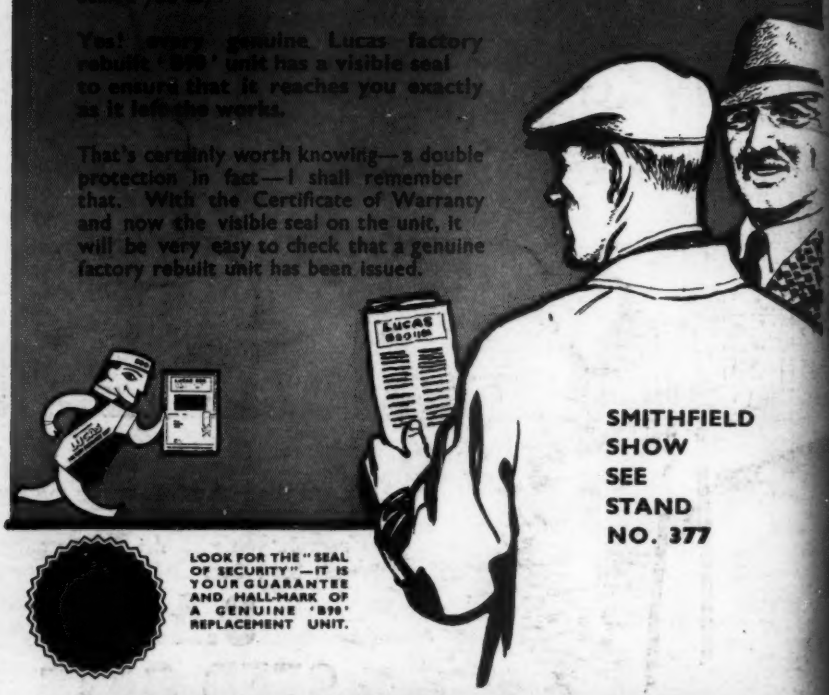
What in addition to the Certificate of Warranty?

Yes! The seal gives you a further guarantee against the many imitation "Lucas Type" Exchange Units being used in electrical repairs.

Sealed you say?

Yes! every genuine Lucas factory rebuilt "BRP" unit has a visible seal to ensure that it reaches you exactly as it left the works.

That's certainly worth knowing—a double protection in fact—I shall remember that. With the Certificate of Warranty and now the visible seal on the unit, it will be very easy to check that a genuine factory rebuilt unit has been issued.



SMITHFIELD SHOW SEE STAND NO. 377

LOOK FOR THE "SEAL OF SECURITY"—IT IS YOUR GUARANTEE AND HALL-MARK OF A GENUINE 'BRP' REPLACEMENT UNIT.

[redacted]

IMMEDIATE EXCHANGE SCHEME

JOSEPH LUCAS LTD · BIRMINGHAM 19